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What Explains Prevalence of Informal Employment in European Countries

The Role of Labor Institutions, Governance, Immigrants, and Growth

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Abstract

This paper looks into institutional and other macro determinants of prevalence of informal dependent employment, as well as informal self-employment, in European countries, using European Social Survey data on work without legal contract in on 30 countries, covering years 2004–2009. Consistently with theoretical predictions, quality of business environment has a significant negative impact on prevalence of both types of informal employment. The share of non-contracted employees is negatively affected by perceived quality of public services and positively related to economic growth. Informal self-employment is positively related to growth in Europe at large, as well as in Eastern and Southern Europe. The level of GDP per capita also has a positive impact on the prevalence of informal employment in Europe at large and within Eastern and Southern Europe, whilst an opposite effect is found in Western and Northern Europe. Other things equal, the share of non-contracted employees in the labor force across European countries increases with the minimum-to-average wage ratio, with union density, with the share of first and second generation immigrants, and with income inequality, but falls with stricter employment protection legislation (EPL) and higher tax wedge on labor. Thus it appears that in Europe at large, labor cost effects of EPL and taxes are weaker than their impact via perceptions of job security and law enforcement, along with tax morale and the income effect. Yet the EPL effect on informality is positive (i.e., cost-related) when either Eastern and Southern Europe or Western and Northern Europe are considered separately. Furthermore, within Western and Northern Europe, the minimum wage effect is negative, whilst within Eastern and Southern Europe, the union effect is negative; in both cases, we offer a supply side explanation.

This paper is a product of the Human Development Economics Unit, Europe and Central Asia Region. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at mihazan@lanet.lv.

What Explains Prevalence of Informal Employment in European Countries: The Role of Labor Institutions, Governance, Immigrants, and Growth♣

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♣ ♣ This paper—a product of the Human Development Economics Unit, Europe and Central Asia Region—is part of an effort to understand the underlying factors that determine the size of informal employment in the shadow economy, providing background technical analysis for a forthcoming World Bank regional study "In from the Shadow: Integrating Europe's Informal Labor". Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The paper has greatly benefited from discussions with and suggestions by Truman Packard. I thank Alexander Tarvid for excellent research assistance. The usual disclaimer applies.
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Introduction

Paid work without legal contract is a phenomenon closely related to such fields of economic and social studies as shadow economy, tax evasion, trust in and efficiency of institutions, labor demand and labor supply, self-employment, worker mobility, labor market flexibility, social exclusion, social security, and many others. Understanding determinants of the size of informal workforce is thus important both for policy making and for design of institutional reforms. Yet research in this field, especially in European context, has been limited due to lack of data.

This paper employs data from rounds 2-4 of ESS (European Social Survey, 2004-2009) to analyze institutional and other macro determinants of prevalence of informal dependent employment, as well as informal self-employment, across 30 European countries. The measures on prevalence of informal employment used in this paper are those from Hazans (2011a); they include 74 observations on 30 countries. Importantly, for most countries, our data cover the early stage of the economic crisis of 2008-2010; thus the impact of macro factors during different stages of economic cycle is accounted for in our analysis.

The paper aims to contribute to two strands of the literature. Firstly, many scholars have studied determinants of the size of informal economy and informal workforce (e.g., Johnson et al., 1997; Schneider and Enste, 2000; Friedman et al., 2000; Djankov et al., 2003; Loayza et al., 2005; Schneider, 2005; Perry et al., 2007; Kucera and Roncolato, 2008; Bajada and Schneider, 2009; Loayza et al., 2009; OECD, 2009; Torgler and Schneider, 2009; Dreher et al., 2009; Dreher and Schneider, 2010; Schneider et al., 2010; Feld and Schneider, 2010; Fialova and O. Schneider, 2011). Regarding informal employment, an apparent gap (which we are trying to fill) in this literature is lack of multi-country analysis for Europe based on direct survey data on work without legal contract rather than proxy measures of the size of informal dependent workforce[1]. As a theoretical contribution, we provide arguments for the effects of many factors traditionally viewed as promoting informality to have a potential for a reversal. Accounting for joint determination of informal wage employment, informal self-employment, and unemployment is another distinctive feature of our analysis. We also provide empirical support for the positive impact of income inequality and shares of minorities and population with immigrant background on employment informality in Europe.

Secondly, there is a growing literature, following the seminal contribution by Layard et al. (1991), on the impact of institutions on labor market performance. We refer to Blanchard

[1] Previous multi-country survey-based studies on undeclared work in Europe (Riedmann and Fischer, 2008; Williams and Renooy, 2008; Feld and Schneider, 2010) have focused on undeclared activities and earnings rather than on informal employment relationship.

(2006), Eichhorst et al. (2008), and Lehmann and Muravyev (2009) for extensive surveys of this literature. Some of the recent developments have been related to complementary policies and interaction between institutions (e.g., Belot and van Ours, 2001; Amable et al., 2007; Fiori et al., 2007; Bassanini and Duval, 2009; Lehmann and Muravyev, 2009); extending the empirical base and theoretical analysis of institutional framework to transition and developing countries (Boeri and Terrell, 2002; Heckman and Pagés, 2004; Svejnar, 2004; Eamets and Masso, 2004; Ederveen and Thissen, 2007; Hazans, 2007; Feldmann, 2009; Fialova and O. Schneider, 2009; Behar, 2009; Lehmann and Muravyev, 2009; Muravyev, 2010, among others); identifying differential impact of institutions on various demographic groups (e.g., Amable et al., 2007; Bertola et al., 2007; Hazans, 2007; Say, 2011); assessing labor market impact of product market and/or financial market regulations (Amable et al., 2007; Fiori et al., 2007; Loayza et al., 2009; Fialova and O. Schneider, 2011, among others); and robustness checks of the results using alternative panel data methods (e.g., Baccaro and Rei, 2005; Amable et al., 2007).

Most contributions in this body of the literature focus on unemployment and/or inactivity and ignore informal employment. To our best knowledge, Fialova and O. Schneider (2011) is the only paper in this literature addressing the informal employment issue (using proxy measures) in a more or less complete institutional framework. With regards to this strand of the literature, our contributions include: amending institutional variables with the shares of minorities and population with immigrant background; identifying a significant interaction between union density and minimum wage level; finding region-specific product-market-related factors which affect employment informality; and applying mixed-effects and other panel data estimators which have not been used in this field.

Motivated by different data patterns found in Eastern and Southern Europe vs. Western European and Nordic countries (see Figures 1-3), we have conducted analysis separately for these two country groups, as well as for Europe at large.

The rest of the paper is organized as follows. Section 1 provides a simple multi-period model in which agents choose (in the random utility maximization framework) between various labor market states (including formal and informal employment), and firms decide on optimal mix of formal and informal workers. Theoretical predictions on the impact of institutional and other macro factors on informal employment are derived and discussed in the context of previous literature. Section 2 outlines econometric methodology. Section 3 (respectively, 4) describe in detail the model specifications and results for Eastern and Southern (respectively, Western and Northern) Europe. Results for Europe at large are presented in Section 5. Section 6 concludes.

1 Macro determinants of informal employment: Theoretical considerations

Consider a multi-period model[2] of an economy whose state is described by a vector $\boldsymbol{z}$ of macro factors related to the income level, economic growth, fiscal burden, labor market institutions, etc.; hereafter we omit the time subscript from notation of the values of both macro and micro level factors. The economy is populated by heterogeneous agents, each of whom can be in one of the following states: (i) Formal employee *EF*; (ii) Formal self-employed *SEF*; (iii) Informal self-employed *SEI*; (iv) Informal employee *EI*; (v) Unemployed *U*; (vi) out of labor force *O*.[3] There are four types ($k = 1, 2, 3, 4$) of agents, with comparative advantage (see Heckman and Sedlacek, 1985) in formal dependent employment ($k = 1$), formal or informal self-employment ($k=2$), informal dependent employment ($k = 3$), and home production ($k = 4$). The type depends on characteristics like initiative, risk attitudes, taste for autonomy, family status, etc. At a given moment of time, expected life-time utility of a type k agent in state $j \in \{EF, SEF, SEI, EI, U, O\}$ is determined by the macro factors $\boldsymbol{z}$, agent's accumulated wealth $y \geq 0$ and a vector of other observable variables $\boldsymbol{x}$ describing agent's human capital, experience, and location:

$$U_j = u_{j\,k}(y, V) + \varepsilon_j\,,\; V = \boldsymbol{x}\boldsymbol{\beta}_j + \boldsymbol{z}\boldsymbol{\gamma}_j \qquad (1)$$

where V is the present value of the best of the vacancies (including the present job if any) available for the agent in the state j, $\boldsymbol{\beta}_j$ and $\boldsymbol{\gamma}_j$ are given [vector] parameters (state-specific returns to micro and macro factors[4]), $a = \boldsymbol{x}\boldsymbol{\beta}_j$ is the expected productivity (for $j = EF, EI$ it can be seen as 'productivity signal' observed by employers), u_{jk} are given utility functions, and ε_j are random 'errors'. The role of the type is reflected by the following condition:

$u_{sk}(y, v) > u_{jk}(y, v)$ for any $y, v \geq 0, j \neq s$, if type k has a comparative advantage in state s (2).

In the random utility maximization framework (McFadden, 1981), an agent chooses the state in which $U_j = \max$. Of course the comparative advantage can be 'beaten' by a sufficient

[2] A continuous-time model, as in Bosch and Maloney (2010) and Nikolovova et al. (2010), are better suited for studies of flows between formal and informal sector, but for our purposes a discrete time model is sufficient

[3] We consider an employee to be formal if he/she holds and employment contract, and informal otherwise (secondary jobs are ignored in this model). For the self-employed one can apply various definitions of (in)formality, and for the theoretical model it does not matter; see Table 1 and Section 2 for operational definition used in the empirical part of this paper.

[4] In this paper, the model serves only as framework for discussion of effects of institutional factors on informality rates over time and across countries. No attempt is taken here to describe the model in its full generality.

difference in $\boldsymbol{x\beta}$ and/or $\boldsymbol{z\gamma}$ between labor market states, so that agents are not necessarily found in the states where they have advantage, and they might switch states over time.

The productive part of the economy consists of formal and informal enterprises (see ILO, 2003; Hussmanns, 2004), including those of (formal and informal) own-account workers. A formal enterprise has a (firm-specific) production function $Q = Af(K, L_1, L_2)$, where Q is output per period, K is the capital stock, L_1 and L_2 – labor input of formal and informal workers[5], respectively, A – total factor productivity. Likewise, an informal enterprise has a production function $Q = Ag(N, L_2)$, where the capital stock is denoted by N to account for the different type of capital used by informal firms. Assuming for simplicity that firms are competitive in the product markets, profit maximization requires that[6]

$$\frac{MP_{L_1}}{ME_{L_1}} = \frac{MP_{L_2}}{ME_{L_2}} = \frac{MP_K}{r_1} \text{ for a formal enterprise; } \frac{MP_{L_2}}{ME_{L_2}} = \frac{MP_N}{r_2} \text{ for an informal enterprise, } (3)$$

where the MP's are the marginal products of respective inputs, the ME's are the marginal expenses for the given categories of formal and informal workers, whilst r_1 and r_2 are the rental rates of the capital used by formal and informal firms. For informal workers ME_L is, in most cases, just the wage rate, whilst for formal workers it exceeds wage rate and depends on taxes and regulations. It follows then from (3) that, given the values of macro factors $\boldsymbol{z}$, there is a natural productivity threshold for an applicant to be accepted as a formal employee:

$$j = EF \Rightarrow \boldsymbol{x\beta}_{EF} \geq a^* = a^*(\boldsymbol{z}) > 0; \quad (4)$$

agents with $\boldsymbol{x\beta}_{EF} < a^*$ can only count on informal jobs or self-employment. Any increase in cost of formal labor will push a^* upwards. Likewise, a reduction in cost of capital and/or in cost of informal labor will make the entry requirement a^* for a formal job higher.

There is also an entry barrier (credit constraint) to the formal self-employment in terms of financial capital: $y \geq y^* > 0$ for $j = SEF$.

At the beginning of each period, every enterprise for which equality (3) has been distorted during the previous period (due to changes in the capital stock, prices, regulations, and/or worker turnover), opens vacancies and/or fires some workers to restore (3).

[5] Perry et al. (2007) for Latin America and Hazans (2011a) for Europe provide evidence that use of informal labor by formal enterprises is common. See also ILO (2003). However, L_2 can of course be zero.

[6] To simplify notation, we assume that each firm employs no more than one type of formal labor and no more than one type of informal labor, and that market wage rate for the given type of *informal* workers is the same in formal and informal enterprises.

The literature (see e.g. Schneider and Enste, 2000; Loayza et al., 2005; Schneider, 2005; Perry et al., 2007; Oviedo et al., 2009; Torgler and Schneider, 2009; Schneider et al., 2010; Dreher and Schneider, 2010; Feld and Schneider, 2010; Fialova and O. Schneider, 2011) has identified several broad (and partly overlapping) groups of determinants of the size of informal economy in general and informal employment in particular:

(A) Labor market institutions:

(A1) Strictness of employment protection legislation (EPL),

(A2) Presence and level of minimum wage,

(A3) The influence of trade unions,

(A4) The level of spending on active labor market measures,

(A5) Generosity of unemployment and social assistance benefits available to the unemployed and discouraged workers;

(B) The fiscal burden in general and the tax wedge on labor in particular;

(C) Other regulations associated with starting, running, and closing a formal business: entry, trade, financial markets, bankruptcy, and contract enforcement (*product market regulations*);

(D) The quality of the public goods and services (social security, health care, education, perceived fairness of the tax and benefit system, quality of regulatory framework, freedom from corruption, criminal law enforcement, etc.)

(E) Social norms, including tax morale;

(F) Income inequality;

(G) Presence of sizable population groups which are exposed to social exclusion or labor market discrimination (immigrants, minorities, etc.)

(H) The level of economic development.

Most of the institutional and other macro factors affect informality through the country's income level and/or economic growth. The relationship between the income (economic development) level and informal employment is not straightforward. A higher income level increases demand for both formal and informal labor (income or scale effect), but also shifts the demand from cheaper informal sector products and services to more expensive formal sector options (substitution effect). On the supply side, higher income level translates into higher formal sector earnings and welfare benefits, thus reducing pressure on unemployed household members to accept informal jobs. The overall effect of the *level* of economic development is thus ambiguous, especially if one takes into account that the formal market might fail to supply some luxury products and services. Likewise, the effect of

economic growth (or business cycle) is ambiguous as well. On the supply side, during a downturn workers are more likely to accept any job, including informal. On the demand side, the above mentioned substitution and scale effects, opposite to each other, are at work. During the boom periods, the time constraint might be another important consideration[7]: formal enterprises might find the formal procedures too slow when they need to react to fast developments in the product markets.

Perry et. al. (2007) argue that labor market institutions and labor taxation (see (A) and (B) above) work through three channels. First, institutions which tend to increase labor costs hamper job creation and enhance job destruction in the formal sector. Second, institutions and contributions which reduce take-home pay and/or worker time flexibility without providing a sufficient (from the worker perspective) compensation, motivate voluntary opt out of the formal labor market. This channel is obviously interacting with other factors, such as the quality of the public goods, tax morale, and income inequality. Finally, rigid labor market institutions, through disincentives effects, have a long-term adverse impact on productivity and growth. In case of Latin American (LA) countries, Perry et. al. (2007) consider the latter channel to be pro-informal (like the first two channels), because they find informality in LA to be strongly negatively associated with the level of economic development. We argue that the scale effect which reduces the demand for formal labor might reduce the demand for informal labor as well. Moreover, recent research on flows between formal and informal employment (Bosch and Maloney 2010; see also Hazans 2011a: Figure 3), indicates that dependent informal employment (defined as work without contract rather than just tax evasion) might also be pro-cyclical, so *a priori* the indirect effect of rigid institutions on level of informal employment is ambiguous.

Table 2 summarizes the predictions of our model with respect to the effects of above mentioned groups of factors (A) – (G) on the share of informal employment in the [extended] labor force. Many of these predictions, perhaps in a slightly different form, are found in the previous literature, but some are new. In particular, we provide arguments for the effects of many factors traditionally viewed as promoting informality to have a potential for a reversal. To avoid excess ambiguity, we assume that GDP level and growth are controlled (as it will be the case in our analysis), thus discussed above *indirect* (via income and growth) scale and substitution effects of institutions on informality can be omitted (except for the tax effects). It is worth noting that the table refers to the share of informal workers in the labor force rather than to their absolute number (or population share): the latter might slightly increase even when the former is falling; we consider such a development as a reduction of informality.

[7] I thank Truman Packard for this insight.

Table 2 Effects of Institutions and Other Macro Factors on the Share of Informal Employment in the Labor Force, assuming that GDP level and growth are controlled

Employment protection legislation (EPL)
(+) *Demand side:* A stricter EPL increases ME_{L_1}/ME_{L_2} thus leading to (i) an increase in demand for informal labor from formal enterprises; (ii) an increase in motivation to become an informal rather than formal self-employed; (iii) an increase in motivation for formal enterprises to become informal; (iv) a higher threshold for an applicant to be accepted as a formal employee. Indirectly, lower income level increases the demand for cheaper products and services provided by informal sector at the expense of their formal sector substitutes. (-/+) *Supply side*: Workers might perceive a stricter EPL as enhancing job security, which makes formal jobs more desirable thus reducing voluntary exit from the formal labor market; however, job security has an ambiguous effect on cost of formal labor, which can either increase due to better bargaining position of workers or decline if workers accept lower wages when EPL is stricter (Lindbeck and Snower, 1986; Booth and McCulloch, 1996).
Presence and level of minimum wage
(+) *Demand side:* The same effects as for EPL. The effects might be weaker if and where the minimum wage is not binding, or if it is not enforced. (-) *Supply side*: A minimum wage which is substantially higher than earnings in the informal sector makes formal jobs more desirable. Moreover, an increase in minimum wage leads to larger flows from inactivity to seeking formal employment, thus reducing the informality base.
The influence of trade unions
(+) *Demand side*: Unrealistic union demands might increase ME_{L_1}/ME_{L_2} leading to the same effects as for EPL. Moreover, unions tend to push for stricter EPL, which might lead to higher informality, as argued above. (-) *Demand side*: Presence of trade union makes it more difficult for the firm management to engage in informal activities. (-) *Supply side*: By providing formal employees with a voice and influence in the workplace, unions might increase job satisfaction and make formal jobs more desirable; they may also enhance the supply side effect of the EPL.
Spending on active labor market measures
(-) *Demand side:* ALMP coordinated with formal enterprises might reduce their hiring and training costs, thus facilitating job creation in the formal sector. ME_{L_1}/ME_{L_2} might become lower as well, thus creating substitution effect in favor of formal jobs. (- /?) *Supply side*: To the extent ALMP increases outflows from unemployment to formal employment, ALMP spending are expected to reduce informality (in particular, by helping the unemployed to overcome the formal employability threshold, see (4)). The empirical evidence on the effect of ALMP on employability is, however, mixed and depends crucially on the design of the active measures (see Card et al., 2009).
Generosity of unemployment and social assistance benefits
(-) *Supply side*: A higher income provided during unemployment reduces pressure and willingness to accept informal job and ensures that the unemployed can afford a longer search for a good match in the formal labor market. Put other way, higher non-labor income reduces labor supply, and this applies to both formal and informal sector. (+) *Supply side*: Higher benefit and longer benefit duration tend to increase the duration of unemployment and hence the overall unemployment level. Assuming that an unemployed person is more likely to accept an informal job than his employed counterpart[8], this might increase the informality level.
Product market regulation burden
(+) *Demand side*: A larger regulatory burden hampers innovation and technological change, presents barriers to trade and in other ways reduces quantity and diversity of goods and services offered in the formal market. This creates possibilities for informal sector to step in thus stimulating the demand for informal labor. This substitution effect is likely to dominate if GDP level and growth are controlled.

[8] The validity of such an assumption depends on the benefit replacement rate and duration, on perceived risk of being caught and sanctioned, and on whether the benefit recipients are engaged in activation measures on a regular basis. Fialova and O. Schneider (2011) also argue that the overall effect of spending on passive labor market measures is rather ambiguous. Whilst sharing this conclusion, we do not accept their argument that higher passive LMP spending „might strengthen the incentive for operating informally while receiving unemployment benefits at the same time". If someone goes for this option, why should not he/she do the same under a lower benefit?

The fiscal burden in general and the tax wedge on labor

(+) *Demand side:* Higher fiscal burden increases relative price of formal labor as opposed to informal (as well as the marginal cost of production in general, but this is accounted for by controlling for GDP level and growth). Hence, the same substitution effects as for EPL are at work.
(+) *Supply side:* A higher tax wedge increases the net income gain for a worker choosing informal employment as opposed to formal one with the same labor costs for employer.
(+) *Supply side:* Higher tax rates, especially if combined with low trust in the social security system and perceived low quality of the public goods, increases motivation for tax evasion, thus further undermining the provision of public goods and strengthening motivation for working informally.
(?) *Demand and supply side:* Higher tax rates reduce after-tax income level, which, as argued above (see also Andreoni et al., 1998), has an ambiguous effect on informality.
(-) High taxes might signal state's ability to collect them and/or inherently higher tax morale in the country.

Quality of investment climate

(-) *Demand side:* Given that transnational companies are large and usually subject to thorough auditing procedures, they are less likely to use informal labor than other formal enterprises. Hence, one should expect that better investment climate, through increased FDI, reduces the share of informal employment.
(-) *Supply side:* Transnational companies, via higher wages and/or employee benefits, as well as better working conditions foster attractiveness of formal jobs.

The quality of the public goods and services

(-) *Demand and supply side:* Perceived high quality of public goods and efficiency of the state institutions lead to a higher tax morale and lower willingness to enter informal sector on both sides of the labor market.
(-) *Demand side:* Higher quality of the public goods and services leaves less 'supply gaps' to be filled by informal sector.
(-) *Demand side:* A more efficient regulatory framework reduces incentives for tax evasion and makes it more difficult and more risky to go informal.

Inflation and price controls

(+) *Demand side:* Inflationary pressure on wages is likely stronger in formal sector, making a marginal unit of informal labor cheaper relatively to its formal substitute. In addition, price controls create incentives to avoid them via informal enterprises.
(+) *Supply side:* Both inflation and price controls are likely to make population less happy, undermining trust in the government and tax morale.

Social norms and tax morale

It is well documented in the literature that public perception of acceptability of tax avoidance in general and informal employment in particular is an important determinant of the size of informal economy and the level of informal employment (see e.g. Hanousek and Palda, 2003; Torgler 2007, 2010; Torgler and Schneider 2009; Schneider et al. 2010; Torgler et al. 2010).

Income inequality

(+) *Supply side:* Chong and Gradstein (2007: 160) argue that when high inequality is a result of low institutional quality and state capture, poor individuals see „find it beneficial to move into the informal sector, where although less productive, they are able to fully retain their production output", and this leads to a positive relationship between inequality and informality. This also follows from our model, as poor individuals are more likely to fall below both the 'productivity signal' threshold for formal employment and the income threshold for formal self-employment. Perry et al (2007: 239) argue that high income inequality creates a perception that the state is run in the interests of a narrow group; this, in turn, leads to lower tax morale and higher informality. They also argue that in the high inequality framework „it is more difficult to collect revenues in a fair and efficient way"; hence the quality of state services is poor, and the middle class is not getting good value for the money paid in taxes, which further increases informality.

Vulnerable population groups

(+) *Supply side:* Immigrants, minorities and other vulnerable groups are likely to be "less aware of employment protection regulations and less likely to claim their rights" (Say, 2011). For this reason, but also due to labor market barriers they likely to face (see Kahanec and Zaiceva, 2009; Kahanec et al., 2010; Kahanec and Zimmermann, 2011 and references therein), representatives of these groups are more likely to accept informal jobs; Diaz-Serrano (2010) and Hazans (2011a, 2011b) provide empirical evidence. Moreover, immigrants from high informality developing countries are likely to reproduce the kind of informal enterprises which are common in their home countries. Hence, a larger share of immigrant and/or minority population might lead to higher informality. It is fair to note, however, that this is not necessarily the case: an alternative scenario is 'specialization', or segmented labor market, without an effect on the size of informal sector.

2 Econometric methodology

The data at hand (see Table 1) are unbalanced short panel data. Our main focus is on informal dependent employment (work without contracts). However, this form of employment relationship is just one among the alternatives to formal employment, along with informal self-employment, unemployment and discouragement[9]. To account for the fact that all these alternatives are shaped by the same policies and economic circumstances, we start with seemingly unrelated regression (SUR) estimates (see Greene 2008: 254-269; the origin of the method is Zellner, 1962) of the institutional and other macro determinants of the shares of informal dependent employment and informal self-employment, as well as the total share of unemployed and discouraged workers in the [extended] labor force. We use the version of SUR developed by Weesie (1999) and implemented in Stata® *suest* procedure (StataCorp, 2005) which applies cluster modification of White (1982) sandwich robust standard errors. In our case, errors are clustered on countries and are of course allowed to correlate across the three models. The estimated effects reflect variation of institutional and other macro factors both within and between countries. Exogeneity of suspected variables (e.g., government effectiveness) is tested using 2-step GMM clustered IV estimates (Baum et al. 2007); in few cases when exogeneity is rejected, the respective variable is instrumented; see Annex 2 for details.

For determinants of informal dependent employment we present additional estimates of various panel-data models which allow either for a more general error correlation structure than our SUR estimates or for a more specific modeling of within-country error correlation; in addition, some of the models include country and/or region level random effects.

First, we use Prais-Winsten regressions (see Davidson and MacKinnon, 1993: 343-351; Beck and Katz, 1995), with errors corrected for country-level heteroscedasticity and country-specific AR1 correlation[10].

Second, we apply multi-level mixed-effects linear models (see e.g. Greene, 2008: 233-238; Rabe-Hesketh and Skrondal, 2008), with country level random effects and/or random coefficients; errror variance is estimated separately in each of the four European regions (North, West, East, and South)[11]. These models are fit by restricted maximum likelihood

[9] See Notes to Table 1 for definitions. See Hazans (2011a) for more details and discussion.

[10] We have also estimated versions of Prais-Winsten regressions where errors are allowed to correlate across panels (countries) thus reflecting the common macro factors beyond those captured by GDP level and growth variables, but the AR1 correlation is assumed to be common rather than country-specific. These estimates are similar to but less accurate than those reported in the paper.

[11] Mixed-effects models allow various types of within-country correlation of errors e_{it}. The mixed-effects models presented in this paper (unlike other models presented here) assume independent errors; these models provide better fit than otherwise similar (not reported) ones with region-specific AR1 or exchangeable

method. The role of within variation is more pronounced in mixed-effects models than in other models used here.

Finallly, we use population-averaged panel-data models with semi-robust standard error's clustered on countries, where results are obtained by averaging country-level random effects across the sample (see Liang and Zeger, 1986; Zeger et al., 1988; StataCorp, 2005; Greene, 2008:188). Within-country error correlation is not restricted (unstructured) in most specifications, whilst in others all off-diagonal error correlations within panels are assumed equal. These models are estimated by the generalized estimating equations (GEE) method.

Importantly, mixed-effects models and population-averaged models do not impose the restrictive assumption of the classic random-effects model that the random effects are not correlated with Xs; moreover, in contrast with the fixed-effects models, time-invariant variables are allowed (Greene, 2008)[12].

For all models, we provide robustness checks by varying country coverage and explanatory variables.

3 Macro determinants of informal employment in Eastern and Southern Europe

Table 3A presents seemingly unrelated regression estimates, with errors clustered on countries (see Section 2 for details and references), of the institutional and other macro determinants of the shares of informal dependent employment and informal self-employment, as well as the total share of unemployed and discouraged workers in the [extended] labor force of Eastern and Southern European countries in 2004-2009. Countries covered include the Czech Republic, Slovakia, Poland, Hungary, Estonia, Latvia, Slovenia, Bulgaria, Romania, Russia, Ukraine, Spain, Portugal, and Greece. For all countries but Romania we have three or (in few cases) two observations, including one during the economic crisis period (late 2008 or 2009).

Table 3A presents two specifications: {1} = {[1a], [1b], [1c]} and {2} = {[2a], [2b], [2c]}. Both specifications include the following six explanatory variables (detailed definitions and sources of these and other explanatory variables are found in Annex 1):

(i) *EPL_2*: Employment protection legislation strictness (OECD, version 2);

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correlation, whilst our short and unbalanced panels are not suited for more general correlation structures. Note, however, that mixed-effect model counterparts of the idiosyncratic errors in the SUR or Prais-Winsten regressions are the "overall residuals" which include the random effects and are correlated within panels even if e_{it} are independent.

[12] Another approach which combines these two advantages is Hausman and Taylor's estimator (see Greene, 2008: 336-340), but it is more restrictive.

(ii) *MIN_WAGE*: minimum wage level (expressed as percentage of average wage in industry and services)[13];

(iii) *GDP_PC*: log GDP per capita in PPP USD (annual average, lagged 1 year);

(iv) *GROWTH:* Real GDP growth, y-o-y, quarterly data lagged 1 quarter;

(v) *UNION:* Union density, % of employees (survey-based, using ESS data)[14];

(vi) *IMMIGR:* Share of population with immigrant background: first generation immigrants and second generation immigrants (survey-based, using ESS data).

In addition, specification {1} includes

(vii) *RULE_LAW*: the *Rule-of-Law* indicator (on a scale from -2.5 to 2.5) from the World Governance Indicators (Kaufmann et al., 2010; World Bank, 2010).

(viii) *TAX_WEDGE:* Tax wedge for low wage earners (lagged 1 year).

Specification {2}, instead of *RULE_LAW* and *TAX_WEDGE*, includes

(ix) *GOV_EFFECT:* The *Government Effectiveness* indicator (on a scale from -2.5 to 2.5) from the World Governance Indicators (see Kaufmann et al. 2010; World Bank, 2010).

(x) *INVEST_FREE:* Investment Freedom – the Heritage Foundation (2010) index (on a 0 to 100 scale) which "evaluates a variety of restrictions[15] typically imposed on investment"; a higher score indicates less restrictions (more freedom);

(xi) *TRADE_FREE:* Trade Freedom – the Heritage Foundation (2010) index (on a 0 to 100 scale) which "is a composite measure of the absence of tariff and non-tariff barriers that affect imports and exports of goods and services"; a higher score indicates less barriers (more freedom).

Both specifications explain about 80% of variation in the prevalence of informal dependent employment and slightly more than a half of variation in unemployment and discouragement; in the case of the prevalence of informal self-employment, specification {1} explains 64% of variation, whilst specification {2} explains 79% (these R-squared are from underlying OLS regression). There are no cases of significant effects having opposite signs in

[13] Note that this measure is likely to capture the employment-depressing effect of minimum wage better than the alternative which uses economy-wide average wage.

[14] Alternative specifications (available on request) which use union density lagged two years back (either from the previous ESS round, or from OECD database) give similar results, but with larger estimated mean squared errors.

[15] Labor market regulations are not included in this index, as they are covered by another Heritage index.

the two specifications. To sum up, both specifications do a fairly good job in explaining employment informality. Note that the models in Table 3A do not include country or time fixed effects.

Both specifications suggest that the minimum wage level, the strictness of employment protection legislation, and the level of GDP per capita have a positive and highly significant impact on the shares of both non-contracted employees and informal self-employed in the labor force[16]. The proportion of population with immigrant background has such an impact only on the share of employees working without contracts. The effect of EPL and minimum wage are consistent with the results of Fialova and O. Schneider (2011) obtained using different informality measures and different econometric methods. In addition to the *level* of economic development (captured by GDP), the economic *growth* also has a positive effect on employment informality (which thus appears to be pro-cyclic in Eastern and Southern Europe), although this effect is significant only in specification {2}. Comparison with the theoretical predictions discussed earlier in this section and/or in Table 2 indicates that for the EPL and the minimum wage the demand side effects prevail, whilst for the income and growth, the scale effect dominates the hypothetical substitution of cheap informal goods and services by formal ones.

Furthermore, specifications [1a], [2a], [1b] and [2b] in Table 3A indicate that union density has a significant negative effect on employment informality (for dependent and self-employment alike), suggesting that monitoring, voice and job security factors are more important that the impact unions might have on labor costs. In accordance with theoretical predictions, the quality of public services (the Government Effectiveness index), the quality of investment climate (the Investment Freedom index), and trade freedom all have a negative impact on informal dependent employment (specification [2a]); the investment freedom has also a negative effect on informal self-employment (specification [2b]), whilst the trade freedom reduces unemployment and discouragement (specification [2c]).

The tax wedge also has an "expected" (recall from Table 2 that theoretically the effect is ambiguous) positive effect on informal dependent employment (Table 3A, specification [1a]), although it is significant only at 10% level. Moreover, this variable does not contribute a lot to the model's explanatory power, whilst specification [2a] explains almost the same proportion (79% vs. 81%) of variation in the share of informal employees without accounting for any measure of the tax burden. It seems that the tax rates are not of primary importance in determining the level of informal employment in Eastern and Southern Europe.

[16] It is worth noting that the minimum wage level is found to have an equally significant positive effect on unemployment/discouragement (Table 3, specifications [1c], [2c]).

The remaining variable in specification {1}, the *Rule-of-Law* index, which captures the tax morale, but also the perceived quality of the public services related to law and order, personal security and property rights, as well as the effectiveness of the fiscal system, as expected, has a highly significant negative effect on both types of informal employment (Table 3A, specifications [1a], [1b]). The exact interpretation of this effect is difficult because this index is more heterogeneous by construction than the other indices used here (Government Effectiveness, Investment Freedom, and Trade Freedom), and the contribution of each of the many index components is not identifiable. Moreover, among many components of the Rule-of-Law index, two (perception of tax evasion and perception of effectiveness of the fiscal system) are endogenous with respect to the past values of the share of informal employment[17], thus adding some "informality persistency" effect (similar to but weaker than if the model would include lagged values of dependent variables as explanatory). The weight of these components in the overall Rule-of-Law index is however so small (between than 0.02 and 0.05 for the countries and years in question) that, plausibly, this variable can be dealt with as exogenous in the informal employment model. However, same unobserved factors might affect both the (actual and perceived) quality of governance and the levels of informal employment and unemployment in a country, hence both *Rule-of-Law* and *Government Effectiveness* might still be endogenous. We have tested this with 2-step GMM instrumental variable estimates (Baum et al. 2007), and for Eastern and Southern Europe exogeneity was not rejected, with high enough *p*-values, in all six models reported in Table 3A; Annex 2 provides discussion and details. Moreover, for dependent informal employment, the model with instrumented Rule-of-Law is very similar to model {1a}, with the only exception that the coefficient on tax wedge is smaller and not significant. Hence we keep specification {1} as is, with non-instrumented contemporary (to account for an almost immediate impact of tax morale on informality) Rule-of-Law. The results are similar (and available on request) if the lagged values of *RULE_LAW* are used for countries/years where ESS field work has started earlier than in September of respective year, although these models have lower R-squared; if *RULE_LAW* is lagged for all cases in the sample, the results are also similar but do not capture the tax wedge effect (and R-squared declines further).

However, as we focus on institutional factors rather than the persistency effect, our preferred specification is {2}, in which all variables can be treated as strictly exogenous or

[17] We refer to *past* values here taking into account the time lag between field work of the country-specific surveys underlying WGI (for the items in question, these are the World Competitiveness Yearbook Executive Opinion Survey and World Economic Forum Global Competitiveness Survey, with field work performed early in the calendar year to which the data refers) and ESS surveys (in most cases, late in the year for Eastern and Southern European countries, see Table 1).

predetermined. In what follows, we refer to the numerical values of the effects in this specification (qualitatively, they are broadly similar to the ones in specification {1}).

The results in Table 3A indicate that a unit increase in EPL index, other things equal, will raise the shares of dependent informal employment and informal self-employment by about 2 percentage points each, other things equal. An increase in minimum wage level relative to average wage in industry and services by a one percentage point will raise the shares of dependent informal employment and informal self-employment by at least 0.3 percentage points each, whilst the rate of unemployment and discouragement will go up by 0.45 percentage points. A one percentage point increase in union density reduces informal dependent (respectively, self-) employment by 0.25 (respectively, 0.4) percentage points, other things equal. Interestingly enough, these effects are similar in size but opposite in direction to the ones caused by a 10% increase in GDP per capita (at PPP). On the other hand, an increase in year-on-year real economic growth by a one percentage point pushes the shares of dependent informal employment and informal self-employment up by 0.13 and 0.15 percentage points, respectively. A one percentage point increase in the share of population with immigrant background will raise the share of dependent informal employment by 0.2 percentage points and reduce the unemployment/discouragement rate by 0.1 percentage points.

A unit increase in the Government Effectiveness (respectively, Investment Freedom; Trade Freedom) index results in a reduction of the share of dependent informal employment by 5.3 (respectively, 0.18; 0.07) percentage points, other things equal.

In order to compare the size of the effects different factors may realistically have on the employment informality rates, one can use the change in dependent variable caused by a 1 std. deviation change in *x*. These standardized coefficients are found in Table 9. For dependent informal employment, the largest in absolute value are the effects of the Government Effectiveness and Investment Freedom (about −3.1 percentage points each), followed closely by minimum wage, GDP *per capita* and union density (2.7, 2.6 and −2.6 percentage points, respectively), followed by population with immigrant background, EPL strictness index, economic growth, and trade freedom (1.6, 1.0, 0.8 and −0.7 percentage points, respectively).

Model {2} in Table 3B is similar to model {2} in Table 3A, but controls also for passive and active labor market spending; the samples exclude Russia and Ukraine due to data limitations. Higher unemployment insurance spending (per percentage point of unemployment) seems to reduce both types of informal employment without affecting unemployment significantly, while spending on active labor marker measures tends to reduce unemployment, but does not affect informality. Other results are qualitatively similar to those

in Table 3. However, after excluding two countries (6 observations) with moderate EPL, relatively poor governance, low taxes and high informality, the EPL effect is more pronounced, the impact of government effectiveness is weaker (yet significant), and the positive impact of tax wedge on informality is more significant. Model {1} in Table 3B adds to the sample Italy (which does not have a nationwide minimum wage). The results suggest that the share of informal dependent employment in Italy's labor force (as of 2006) was by about 3 percentage points below the level predicted by the model for "Italy with the average for Eastern and Southern Europe relative minimum wage level".

Table 4 focuses on the dependent informal employment and presents estimates of various panel-data models, providing robustness checks by varying country coverage and explanatory variables. Specifications [1]-[3] are from Prais-Winsten regressions (see e.g. Beck and Katz, 1995), with errors corrected for country-level heteroscedasticity and country-specific AR1 correlation. Specification [4] is a multi-level mixed-effects linear model (see e.g. Greene, 2008: 233-238), with country-level random effects and random coefficients; errror variance is estimated separately for Eastern and Southern Europe, as are random coefficients on the immigrant population variable. Finallly, specifications [5]-[12] are population-averaged panel-data models (see e.g. Zeger et al., 1988) with semi-robust standard error's clustered on countries, where results are obtained by averaging country-level random effects across the sample; within-country error correlation is not restricted (unstructured) in most of these specifications, whilst in models [5], [6], [10], and [11], in order to achieve convergence, all off-diagonal error correlations within panels are assumed equal.

Most specifications in Table 4 (like specification [2a] in Table 3A) control for [lagged one year] Government Effectiveness, whilst specifications [5], [6], and [11] include the Rule-of-Law indicator (also lagged). In addition, specifications [7]-[12] control for various labor market policy indicators; models [7]-[10] control also for the level of *income inequality* (the Gini index) and the share of local born *minority population* (which replaces the share of population with immigrant background used in models [1]-[6]). Results from all these specifications confirm (for the dependent informal employment) discussed above findings from Table 3A regarding both direction and size of the effects. In what follows we discuss only additional findings from Table 4.

Model [1] drops the tax variable and includes two countries not covered in Table 3A: Israel (2008) and Lithuania (2009). The results are almost identical both to those in Table 3A and to those of model [2] in Table 4 (estimated by the same method), where these countries are again excluded. Models [3]-[5] are estimated by three different methods (see above) on the same sample and with the same variables as model [1a] in Table 3A, so these are pure

robustness checks. The only difference worth noting is that in the mixed-effects model [4] most institutional and macro effects are somewhat smaller in size than in comparison models; this is because country level random effects are included. This model also finds that unobserved factors have a larger impact on the size of informal employment in Southern Europe than in Eastern Europe. The mixed-effects model provides a much better fit than other models[18]. Models [2] and [3], which allow for country-specific error correlation, also have smaller MSE's than comparable models [1a], [2a] from Table 3A.

Model [6] includes *implicit tax rate on labor* (*TAX_RATE*) instead of the tax wedge; this variable appears to be more significant, although the size of the effect remains similar: a one percentage point increase in tax rate leads to a 0.2 percentage points higher share of dependent informal employment; this effects reaches 0.3 (respectively, 0.4) percentage points when active (respectively, passive) labor market measures spending is controlled as well (models [7]-[10]).

Models [7] and [10] (respectively, [8] and [9]) control for (lagged one year) spending on active (respectively, passive) labor market measures (measured in % of GDP per percentage point of unemployment). Both types of measures seem to reduce informal dependent employment in Eastern and Southern Europe: an increase in the above mentioned indicator by 0.01 percentage point leads to a fall in the share of informal dependent employment by 0.7 percentage points in case of active measures and by 0.4 percentage points for passive measures. Note, however, that when the actual variability of these indicators is accounted for, the size of the effect is slightly larger for the passive measures (-2.1 percentage points per a one standard deviation change in spending) than for the active measures (-1.7 percentage points). Moreover, one has to take into account that the effect of active measures depends crucially on their design which differ substantially across countries and time (Card et al., 2009). Nevertheless, the estimated negative effect of active labor market measures on informality is consistent with the theoretical prediction (see Table 2) that ALMP might facilitate job creation in formal enterprises by reducing their hiring and training costs, but also by helping the unemployed to overcome the formal employability threshold.

Passive measures are more comparable, but their effect, too, depends on benefit replacement rate and duration, on perceived risk of being caught and sanctioned when working informally, and on whether the benefit recipients are required to take part in activation measures on a regular basis. The estimated negative effect of passive labor market measures on informality is consistent with the idea that a higher income provided during

[18] Note that the prediction of the mixed-effects model is defined as the sum of the fixed part linear prediction and the best linear unbiased prediction of the random part.

unemployment reduces pressure and willingness to accept informal job and ensures that the unemployed can afford a longer search for a good match in the formal labor market (Table 2). However, Table 2 provides an argument for an opposite effect, too: Higher benefit and longer benefit duration tend to increase the duration of unemployment and hence the overall unemployment level. If an unemployed person is more likely to accept an informal job than his employed counterpart[19], this might increase the informality level. Indeed, models [11]-[12] find that the effect of generosity of unemployment and social assistance benefits (measured by the average unemployment benefit and social assistance net replacement rate over 60 months of unemployment, %) on the informal employment is U-shaped, with the turning point at the net replacement rate of about 55%.

As Figure 3 (left panel) illustrates, the measures of active and passive LMP spending feature a rather strong positive correlation within our sample; this is why it is difficult to disentangle the effects of the two types of spending. A system of seemingly unrelated estimates similar to specification {2} in Table 3A, which includes both types of spending along with other variables from models [9]-[10] of Table 4, suggests that reduction in unemployment is due to ALMP spending, but it is difficult to determine which of the two types of spending is more effective against informal employment – results in this respect are not robust against changing some of the explanatory variables or excluding some countries.

Consistent with theoretical prediction that vulnerable population groups are more likely to be pushed to informal employment (see Table 2 for the argument; empirical evidence is found in Diaz-Serrano, 2010; Hazans, 2011a, 2011b; Say, 2011), models [7]-[10] find a highly significant positive effect of the share of local born minority population on informal dependent employment. This effect is similar in size (and in nature) to the effect of the share of population with immigrant background: The standardized coefficient varies between 1.3 and 1.6 percentage points per a one standard deviation change.

Finally, models [7]-[10] confirm also the prediction of Chong and Gradstein (2007: 160) and Perry et al (2007: 239) that higher income inequality leads to higher informality in the labor market. A one percentage point increase in the Gini index will raise the share of dependent informal employment by 0.2 to 0.4 percentage points; the effect is larger when passive (rather than active) labor market spending is controlled. This effect seems to be causal: we have tested for reverse causality and found that informality does not Grange cause inequality.

[19] Hazans (2011b) provides evidence that persons with a long-term unemployment experience are much more likely to hold informal salaried jobs, other things equal.

Most of our specifications exclude Italy, which does not have a nationwide minimum wage. As a robustness check, models [7] and [8] (like models [1a]-[1c] in Table 3B) assign to Italy a minimum wage at the level of 38.5% of the average wage in industry and services (the mean level for our sample of Eastern and Southern European countries) and include a dummy for Italy. The share of non-contracted employees in Italy's labor force (as of 2006) was by 8 to 10 percentage points below the level predicted by the model with this hypothetical minimum wage level (this effect of absence of a minimum wage is stronger than in Table 3B because this time the Gini index is controlled).

4 Macro determinants of informal employment in Western and Northern Europe

Table 5 presents seemingly unrelated regressions estimating the institutional and other macro determinants of the shares of informal dependent employment and informal self-employment, as well as the total share of unemployed and discouraged workers in the [extended] labor force of Western European and Nordic countries. Countries covered include the UK, Ireland, Netherlands, Belgium, France, Germany, Switzerland, Austria, Norway, Sweden, Finland, and Denmark. For most countries we have three observations which refer to 2004-2005, 2006-2007, and 2008-2009 (see details in Table 1); for France, we miss the first of these biannual cycles, whilst for Austria we miss the last. Austria aside, the most recent data for each country come from a survey implemented during the economic crisis (late 2008 and/or early 2009, except for Ireland where it was a year later).

With few exceptions, the explanatory variables are the same as for Eastern and Southern Europe. The *Rule-of-Law* indicator is not used for Western and Northern Europe. New variables (see Annex 1 for details) include:

(i) *SAT_GOV* – average satisfaction with the national government (on a 0 to 10 scale), from the respective round of the ESS (used only in specification{2})

(ii) *GOV_EXPsq* – government expenditures (consumption and transfers) at all levels as percentage of GDP, squared /100 [20]

(iii) *BUS_FREE:* Business Freedom – the Heritage Foundation (2010) index (on a 0 to 100 scale) which measures „the ability to start, operate, and close a business" and is negatively related to the overall burden of regulation as well as to the efficiency of government in the regulatory process.

[20] This variable is a simple transformation of the Heritage Foundation (2010) Government Spending index: the latter equals 100 – 3×GOV_EXPsq; the transformation has been applied to facilitate interpretation of the results.

(iv) *MON_FREE:* Monetary Freedom – the Heritage Foundation (2010) index (on a 0 to 100 scale) of price stability and absence of price controls.

(v) *NO_MINWAGE* = 1 if a country does not have a minimum wage, 0 otherwise.

Importantly, the models control for spending on labor market measures (expressed in % of GDP per percentage point of unemployment), which, due to data limitations, were not included in the baseline specifications (see Table 3A) for Eastern and Southern Europe.

Table 5 includes two specifications: {1} = {[1a], [1b], [1c]} has among the controls government effectiveness (*GOV_EFFECT*), whilst {2} = {[2a], [2b], [2c]} has satisfaction with the national government (*SAT_GOV*) instead; otherwise the two specifications are identical. Exogeneity of *GOV_EFFECT* and *SAT_GOV* has been tested (see Annex 2 for details); it appears that *GOV_EFFECT* is endogenous with respect to informal dependent employment, whilst *SAT_GOV* - with respect to unemployment (*p*-values of exogeneity tests are below 0.02). Therefore, in corresponding equations, *GOV_EFFECT* is instrumented with duration of ESS fieldwork in the country and the share of local-born minority population, whilst *SAT_GOV* – with mean trust in the police (both instruments refer to the respective ESS round). In remaining four equations, exogeneity is not rejected (p-values 0.30, 0.76, 0.82, and 0.55).

The explanatory power of the models presented in Table 5 is superior to that of similar models for Eastern and Southern Europe presented in Table 3A and discussed above: This time, each model explains at least 90% of variation in dependent variable (these R-squared are from underlying OLS regression); specification {1} provides a slightly better fit when explaining prevalence of both types of informal employment. The results from the two specifications are well in line with each other.

Both specifications suggest that, other things equal, the strictness of employment protection legislation has a positive and significant impact on the share of non-contracted employees[21], indicating that predicted demand side effects are stronger than potential impact of perceived security of formal jobs. This is similar to the situation found in Table 3A for Eastern and Southern Europe, yet in Western Europe and the Nordic countries the EPL seems to be less fundamental determinant of informality, as the effect disappears when either spending on labor market measures or the tax wedge is not controlled[22]. Moreover, simple scatter-plots feature a negative correlation between EPL and informality in Western and Northern Europe, whilst across countries of Eastern and Southern Europe this correlation is

[21] There is a similar effect on unemployment and discouragement rate.
[22] These results are available on request.

positive (Figure 1). Furthermore, in contrast with Eastern and Sothern Europe, the impact of EPL on informal self-employment in the West and in the North is negative (Table 5).

Consistently with theoretical predictions (see Table 2), the quality of public services (proxied by the Government Effectiveness index in specification {1} and by average Satisfaction with the Government in specification {2} of Table 5), as well as the quality of business environment (Business Freedom in specification {1}) have a negative impact on prevalence of both types of informal employment. Higher government expenditures relative to GDP reduce [both types of] informal employment, as well as unemployment, other things (including government effectiveness or satisfaction with the government!) equal. These effects have of course a straightforward demand side explanation.

Monetary freedom is found to have a highly significant negative effect on the share of informal dependent employment (Table 5, specification [2a]). In other words, higher inflation and price controls push more employees into work without a contract[23]. This effect might work through both demand and supply side mechanisms. On the demand side, inflationary pressure on wages is likely stronger in formal sector, which makes a marginal unit of informal labor cheaper relatively to its formal substitute (let aside the scale effect which we ignore because the GDP level and growth are controlled). In addition, price controls create incentives to avoid them via informal enterprises. On the supply side, both inflation and price controls are likely to make population less happy, undermining trust in the government and tax morale.

Contrary to "conventional" predictions (see Table 2), the effect of the tax wedge for low wage earners on the share of informal dependent employment in Western and Northern Europe is negative (and highly significant). This effect is not an artifact, because dropping the tax wedge variable reduces the R-squared of the underlying OLS model by more than 10 percentage points (and adjusted R-squared by more than 15 points). The effect disappears (not becomes positive though) if six observations which refer to Ireland and the UK (countries with relatively low tax wedge and high share of informal employees) are removed from the sample. A possible explanation might be that the [unobserved component of] tax morale in these two countries is substantially lower than elsewhere in Western and Northern Europe, or enforcement is weaker. We come back to this point in the next section. Another explanation for the negative impact of tax wedge on informality is related to the scale effect (discussed in detail in Section 2), as smaller tax burden results in higher after-tax income.

For those countries of Western and Northern Europe where a nationwide minimum wage exists (i.e., the UK, Ireland, the Netherlands, Belgium, and France, with 14 observations

[23] Schneider et al. (2010: Table A4.1) find a positive effect of inflation on the size of the shadow economy in transition countries (in 1994-2006) but not in high income OECD countries (1996-2007).

in the sample), we find a negative and highly significant effect of the minimum wage level on the share of informal dependent employment (as well as on unemployment and discouragement rate); the effect on informal self-employment is positive but rather small (Table 5). Comparison with the theoretical predictions (see Table 2) indicates that the supply side channels of the impact of minimum wage level (through relative attractiveness of formal jobs and through labor force participation) prevail. *Other things equal, an increase in minimum wage level relative to average wage in industry and services by a one percentage point will reduce the share of dependent informal employment by 1.5 to 1.7 percentage points* (Table 5, models [1a]-[2a]). As Figure 2 (right panel) indicates, the effect is to a large extent driven by the UK and Ireland having much lower minimum wage levels and much higher shares of informal employees than the Netherlands, Belgium, and France. However, within-countries slopes for UK and IE are also clearly negative.

On the other hand, in countries which do not have a nationwide minimum wage (Germany, Austria, Switzerland, Denmark, Sweden, Finland, and Norway), the share of informal dependent employment is, on average, by 2.5 percentage points below the level predicted by the model assuming for these countries the average for Western Europe minimum-to-average wage ratio of 42.4% (see Table 5, specification [1a]); Figure 2 shows an even larger gap when other factors are not controlled). This suggests that in the wealthy part of Europe, the demand side effects of minimum wage, as outlined in Table 2, work through existence of the institution as such rather than through its level: institutionalized minimum wage raises the demand for informal labor from formal enterprises, motivates nascent entrepreneurs to enter informal rather than formal sector or to switch from formal to informal, and makes higher the threshold to be accepted as a formal employee.

As discussed in Section 2, the effect of the both level of economic development and economic growth (or business cycle) on the employment informality is theoretically ambiguous. Indeed, both specifications in Table 5 find that the share of informal dependent employment is positively (and highly significantly) related to economic growth (plausibly, through demand side channels - the scale effect and the time pressure), whilst GDP per capita has a negative impact on the prevalence of both types of informal employment (plausibly, through the substitution effect on the demand side and the non-labor income effect on the supply side). Both income level and economic growth significantly reduce unemployment and discouragement, other things equal.

Union density in Western and Northern Europe (27% and 73%, respectively[24]) is much higher than in Eastern and Southern Europe (21% in each case). Hence, one can expect a different impact of unions on informality. Indeed, specifications [1a], [2a], [1b] and [2b] in Table 5 indicate that union density has a significant positive effect on the shares of employees without contracts and informal self-employed: *a 10 percentage points higher union density raises the proportions of the two types of informal workers by 0.9 and 0.3 percentage points, respectively*. A likely explanation is that union pressure makes formal labor more expensive relative to informal, thus increasing demand for informal labor from formal enterprises, strengthening the motivation for enterprises to become (or stay) informal, and raising the threshold for an applicant to be accepted as a formal employee. On the other hand, monitoring, voice and job security factors (see Table 2) seem to be less important. Furthermore, models [3a] and [3b] (Table 5) suggest that unions tend to increase unemployment in Western and Northern Europe: *an increase in union density by 9 percentage points will raise the share of unemployed and discouraged by 1 percentage point*, other things equal.

In contrast with Eastern and Southern Europe, we do not find a significant impact of the share of population with immigrant background on the prevalence of informal employment (this is consistent with the results on individual level determinants of informality in Hazans, 2011b).

Recall from Section 2 that in Eastern and Southern Europe, both active and passive labor market policy (ALMP and PLMP) spending were found to reduce informal dependent employment, but because of correlation between the two types of spending it was not clear whether any of these effects is causal. In Western and Northern Europe, ALMP and PLMP spending (per percentage point of unemployment) are also correlated (Figure 3, right; the correlation is less pronounced among Nordic countries). More importantly, in Western and Northern Europe the median level of both ALMP and PLMP spending relative to GDP is about four times higher than in Eastern and Southern Europe (Figure 3).

In addition to LMP spending, our models include also the average unemployment benefit (UB) and social assistance (SA) total net replacement rate (in percent) over 60 months of unemployment (UBSA)[25]. To avoid spurious effects when combining ALMP, PLMP and UBSA in each of the three equations of specifications {1} and {2}, we have kept the most significant of the three variables and added those which increased explanatory power and

[24] Non-weighted average of country-specific rates.

[25] For Denmark, only the UB net replacement rate (at 66% to 68% for the period in question) was available. Given that maximum UB duration has been 5 years in 1998-2004, and 4 years in 2005-2008, this is a good enough proxy.

improved information criteria, ending up with PLMP and UBSA in the equation for dependent informal employment, ALMP for informal self-employment, and both ALMP and PLMP for unemployment/discouragement (all three variables are lagged by one year).

The results in Table 5 (specifications [1a], [1b], [1c], [2c]) suggest that higher spending on passive labor market measures (per percentage point of unemployment) significantly increases both the unemployment/discouragement rate and the share of informal dependent employment, other things equal; the latter effect is likely to be the consequence of the former, which, in turn works through increasing duration of unemployment (see Table 2). An increase in PLMP spending per percentage point of unemployment by 0.1 percentage point of GDP[26] will raise the share of informal dependent employment by about 2.5 percentage points, other things equal. On the other hand, an increase in the long-term (over a 60 months period) income replacement rate for unemployed by one percentage point reduces the share of informal dependent employment by 0.5 percentage points (part of the latter effect will of course offset the former, but social assistance spending is not included in PLMP). This is in line with Bajada and Schneider (2009), who argue that reducing replacement rates would not only leave without adequate support those unemployed experiencing financial hardship, but it is likely to have little impact on reducing participation by the unemployed in shadow economy. The co-existence of the two above-mentioned opposite effects is consistent with theoretical ambiguity (presented in Table 2) of the impact of generosity of the benefit system on the prevalence of informal employment (recall that a higher income provided during unemployment reduces pressure and willingness to accept informal job and ensures that the unemployed can afford a longer search for a good match in the formal labor market). From the policy choice standpoint, a further study to disentangle the effects of coverage, duration, and generosity of unemployment insurance and social assistance benefits on informal employment is called for.

ALMP spending significantly reduces both the share of informal self-employment and the unemployment/discouragement rate. As discussed in Table 2, ALMP coordinated with formal enterprises likely reduces their hiring and training costs, creating both scale and substitution effects in favor of formal jobs; moreover, ALMP might help the unemployed to overcome the formal employability threshold. An increase in the ALMP spending per percentage point of unemployment by 0.1 percentage point of GDP leads to a fall in the share of informal self-employment by 0.7 percentage points, other things equal.

[26] In our sample, PLMP (respectively, ALMP) varies between 0.03% and 0.49% (respectively, between 0.06% and 0.34%) of GDP per percentage point of unemployment (see Figure 3, right).

To make the effects of various types of spending comparable, one can use standardized coefficients (see Table 9) which suggest that *in Western and Northern Europe, a one standard deviation change in ALMP spending reduces informal self-employment by 0.5 percentage points (whilst the share of unemployed and discouraged is cut by about 2 percentage points). On the other hand, a one standard deviation increase in PLMP spending raises the share of non-contracted employees by 3 percentage points and the unemployment/discouragement rate by about 2 percentage points. Finally, a one standard deviation increase in the average unemployment benefit and social assistance total net replacement rate over 60 months of unemployment reduces the share of non-contracted employees by about 3 percentage points*. When interpreting these findings one should of course keep in mind that the three types of spending rarely change independently of each other.

Table 6 (models [1]-[3]) provide alternative panel-data estimates for determinants of the share of employees without contracts in the labor force of Western and Northern European countries; the explanatory variables are the same as for model [1a] in Table 5. Model [2], in which the estimates are obtained by averaging country-level random effects (possibly correlated with the Xs) across population, confirms all results from model [1a] in Table 5 both qualitatively and in terms of the size of the effects, but ensures a better fit (root MSE is 1.28 vs. 1.51). Results from models [1] (with country level heteroscedasticity and country-specific AR1 error correlation within panels; root MSE is 0.85) and [3] (with country-level random effects possibly correlated with the Xs; root MSE is 0.62) are qualitatively similar, but most effects are smaller in size (although equally significant and with overlapping confidence intervals). The smallest effects are found in the mixed-effects model [3], in which the role of within-country variation of macro factors is most pronounced; for EPL, union density and GDP per capita the effects in this specification are even statistically not significant. The only effect whose sign for Western European and Nordic countries is not robust is the one of the population with immigrant background; note that in the best fitting model [3] this effect is also not significant.

5 Macro determinants of informal employment in Europe at large

As we have seen above, some of the macro level effects have opposite directions in the two part of Europe ("East & South" vs. "West & North"); on the other hand, the analysis conducted so far does not allow to account for large income differences between the West and the East, and substantial differences in social norms between the North and the South. This

section aims at revealing the macro factors which are significant determinants of employment informality in the Europe at large, as heterogeneous as it is.

Models [4]-[6] in Table 6 (similar in specification to models [1]-[3] discussed above) estimate the effects of institutional and other macro factors on the share of employees without contracts in the labor force across Europe. The sample covers all EU-27 countries except Cyprus, Malta, and Luxembourg, plus Norway, Russia, and Ukraine; in total, there are 67 observations on 27 countries. Furthermore, Table 7 presents seemingly unrelated simultaneous estimates of the determinants of the shares of informal dependent employment and informal self-employment, as well as the total share of unemployed and discouraged workers in the [extended] labor force. Specification {1} = {[1a], [1b], [1c]} in Table 7 covers the same above mentioned 27 countries but does not control for spending on labor market measures, whilst specification {2} = {[2a], [2b], [2c]} includes these controls but excludes Russia and Ukraine. In the self-employment models [1b], [2b] the *Government Effectiveness* variable is instrumented (see Annex 2 for details) with median trust in the police, whilst in remaining four models exogeneity of *GOV_EFFECT* is not rejected (p-values range from 0.55 to 0.82).

As expected, government effectiveness and business freedom have a negative and highly significant impact on dependent informal employment across Europe; business freedom negatively affects also informal self-employment. On the other hand, the minimum wage level and short-term economic growth have a positive impact on the shares of both non-contracted employees and informal self-employed, whilst the positive effect of GDP per capita is significant only for dependent informal employment. It appears that in the case of minimum wage the demand side effects prevail, whilst for the income and growth, the scale effect dominates the [hypothetical] substitution effect (see Section 2).

Most specifications suggest that a*n increase in minimum wage level relative to average wage in industry and services by one percentage point will raise the share of dependent informal employment by about 0.35 percentage points* (Table 6, model [4]; Table 7, models [1a], [2a]); one specification (Table 6, model [5]) suggests 0.25 points instead. However, a model with country-level random effects which includes interaction of minimum wage with union density (Table 6, model [6]) provides a more complicated picture: The estimated marginal effect of a 1 point increase in minimum wage on informal employment declines from 0.27 percentage points when union density is 10% to -0.24 percentage points when union density is 50%; the effect is positive for union density values below 31% but significant only if density is less than 20%. The average union density in the sample countries where minimum wage exists is 22.6%, and at this value the marginal effect of minimum wage

increase is still positive (0.11 percentage points), although smaller than in other models and not statistically significant.

In addition, in countries without a nationwide minimum wage (i.e., Germany, Austria, Italy, and the Nordic countries), the share of employees without contracts in the labor force is, on average, by 3 to 4 percentage points below the level predicted for these countries by models [4] and [6] (Table 6), assuming the average (for respective part of Europe) minimum wage level[27].

The effects of union density on informal dependent employment are not significant in the simultaneous models of Table 7, but models which either allow for country-specific error autocorrelation or include country-specific random effects (Table 6, models [4] and [6]) suggest that a higher union density leads to more workers without contracts, other things equal (recall that an opposite effect was found within the sample of Eastern and Southern European countries). The size of the effect is however rather small. According to model [4] in Table 6, a one percentage point increase in union density is expected to raise the share of informal employees by 0.06 percentage points, other things equal; at the same time, the share of informal self-employed is expected to fall by the same amount (Table 7, models [1b], [2b]). Model [6] (Table 6) suggests that the effect of union density on dependent informal employment declines with minimum wage level, being positive as long as minimum wage level is below 41.6% (but significant only if it is below 32%); at the sample mean value of minimum wage of 38.3%, the effect is 0.04 percentage points. Plausibly, unions and minimum wage level are substitutes as long as attractiveness of formal jobs is concerned but complements in terms of raising cost of formal labor.

A 10% increase in GDP per capita (at PPP) is expected to push the share of non-contracted employees up by about 0.4 percentage points, other things equal. An increase in year-on-year real economic growth by a one percentage point will raise dependent informal employment by about 0.1 percentage point.

We have found evidence that (at given unemployment rate) active labor market policy spending tends to reduce informal self-employment and unemployment; passive labor market policy spending tends to increase unemployment, whilst has no significant impact on informal employment.

In accordance with theoretical expectations, the higher is the proportion of first and second generation immigrants in population, and the higher is income inequality, the higher the share of informal employees in the labor force; the inequality effect on informal self-

[27] This effect of existence of minimum wage is not found in models [1a], [2a] reported in Table 7, where this factor is not significant. However, we consider models from Table 6 superior, as they have much smaller MSE's (2.10 and 0.93 vs. 2.97 and 3.11).

employment is also positive (and even stronger), whilst the effect of immigrant population is negative in this case.

We now turn to the factors whose effects are less easily reconciled with either theoretical predictions or results found when analyzing the two parts of Europe separately. EPL strictness and tax wedge on labor are found to reduce informal dependent employment, other things equal. The EPL effect is not totally surprising, given the negative correlation between EPL and informal dependent employment in the raw data within the "West & North" sample (Figure 1, right)[28]. As noted in Table 2, workers might *perceive* a stricter EPL as enhancing job security, which makes formal jobs more desirable and reduces voluntary exit from the formal labor market. It is in principle possible that when all European countries are pooled together, this supply side effect has outweighed the EPL effect on the cost of formal labor. Another explanation is related to the fact that within both "East & South" and "West & North" samples, the low-EPL countries have above average income level: High market wage level works as a substitute for EPL, making formal labor too expensive.

The effect of tax wedge for low wage earners on employment informality is a priori ambiguous, but turned out to be highly significant and sizable negative. We propose the following explanations. First, there is a positive correlation between the tax wedge and the efficiency of the fiscal system across European countries. Countries with high tax rates are also the countries able and willing to enforce them – and vice versa. Indeed, Table 8 provides evidence that proportion of respondents expecting some punishment (fine or prison) for a person whose undeclared economic activity is detected, is positively affected by tax wedge (or tax rates), even when general law enforcement indicator is controlled. [29] Second, a cultural factor might be at work, too – if the tax morale is inherently higher in countries with high tax rates (see evidence in Torgler, 2010). Third, heavier tax burden creates a negative scale effect on [informal and formal] labor demand by formal enterprises, as well a negative income effect reducing demand for informally produced goods and services. Together, these effects (of which the first one is likely the strongest) overcome [labor and product market] substitution effects, as well as distrust effects in favor of informal labor.

6 Conclusions

[28] Moreover, although the EPL effect is positive in the "East & South" models (see Section 3), its contribution to the explanatory power those models is rather small.

[29] Fialova and O. Schneider (2011: Table 4) also find a negative impact of labor taxation on the share of labor force not contributing to the pension system in the sample of 26 European countries; they relate it to „improving quality of public services and provision of a better legal environment in high-tax countries"; our explanation is similar in spirit but not identical.

In this paper, we have studied institutional and other macro determinants of prevalence of informal dependent employment, as well as informal self-employment in European countries. To our best knowledge, this is the first multi-country study which conducts such an analysis for Europe using direct survey data on work without legal contract rather than proxy measures of the size of informal dependent workforce. Accounting for joint determination of informal wage employment, informal self-employment, and unemployment is another distinctive feature of our analysis.

We have conducted analysis separately for three country groups: Eastern and Southern Europe, Western European and Nordic countries, and Europe at large. Table 10 summarizes the directions of the effects across country groups, two types of informal employment, and specifications. A plus sign in a row titled *X* and a column titled *T* for country group *G* indicates that variable *X* has a positive and significant effect on the share of informal employment of type *T* in country group *G* at least in some (typically, in all) specifications reported in that column, and never has a significant negative effect. Minus sign is interpreted in a similar way[30]. Zero refers to a variable insignificant in every specification (within column). In each column, superscripts indicate alternative specifications; entries without superscripts refer to variables common to all specifications[31].

Many factors appear to work in the expected way (or at least in the same way when expectations are ambiguous) in all three country groups. Consistently with theoretical predictions, quality of *business environment* (represented by Business Freedom, Investment Freedom, Trade Freedom, and Monetary Freedom) has a significant negative impact on prevalence of both types of informal employment when other factors, including GDP level and growth, are controlled. Noteworthy, the specific product-market-related factors which appear as significant differ between the two country groups: In Eastern and Southern Europe, these are Investment Freedom and Trade Freedom, whilst in Western and Northern Europe - Business Freedom and Monetary Freedom; when all countries are pooled together, it is Business Freedom which matters.

The share of non-contracted employees is negatively affected by perceived quality of public services (represented by Government Effectiveness, Satisfaction with the Government,

[30] A sign in parentheses refers to a marginally insignificant effect (*P*-values between 0.10 and 0.13).

[31] Table 10 also provides comparisons with the results of four other studies where the dependent variable is one of the following proxies for informal employment: (i) share of labor force not contributing to the pension system; (ii) share of self-employed in the labor force; (iii) share of workers without a contract or with a temporary contract. The results reviewed in Table 10 refer to: Fialova and O. Schneider (2011) – for a panel (2006-2007) of 25 European countries, using all three proxies; Perry et al. (2007) and Loayza et al. (2009) - for cross-sections of 57 to 70 world countries, using proxies (i) and (ii); Loayza and Rigolini (2006) – for a panel (ending in 2004) of 42 world countries and a sub-panel of 18 developing countries, using proxies (i) and (ii).

and Rule of Law variables). These effects are among the largest (in absolute terms) in most specifications and for all country groups.

In emerging Europe (East and South) and in wealthy Europe (West and North) alike, as well as in Europe at large, the share of non-contracted employees is positively related to *economic growth* (plausibly, through demand side channels - the scale effect and the time pressure). The same is true for informal self-employment in Eastern and Southern Europe and in Europe at large, whilst in Western and Northern Europe this effect is absent. These findings suggest that *informal [at the main job] employment is a pro-cyclic phenomenon in Europe*. This is in line with finding by Hazans (2011a), based on 70 observations of 27 European countries, that the rates of dependent informal employment and unemployment never went up simultaneously between 2004 and 2009 [32]. The level of *GDP per capita* has a positive and significant effect on the share of non-contracted employees in Europe at large and on both types of informal employment within Eastern and Southern Europe, again suggesting that the scale effect overcomes both the substitution effect and the supply side effects. Positive association between the income level and employment informality in Europe is in a sharp contrast with the situation found in large samples of either high-income and developing countries across the world, or only developing countries, or in Latin America and the Caribbean (see Loayza and Rigolini, 2006; Perry et al., 2007; their results partly reported in Table 10). However, we find a negative effect of income level on employment informality when the wealthy part of Europe (the West and the North) is considered separately. Fialova and Schneider (2011) find a similar effect on self-employment for the "old Europe" (the West, the North, and the South).

Note that our results are not directly comparable to those of Schneider et al. (2010) and Bajada and Schneider (2009) on determinants of the size of the shadow economy (although theoretical considerations are to a large extent similar, as long as factors controlled in all these studies are concerned). In fact, for 2004-2007 there is virtually no correlation between the size of the shadow economy as estimated in Schneider et al. (2010) and the share of informal (at the main job) employment, be it dependent, or own-account, or total. This is because a formal employee or a formal self-employed might contribute to the shadow economy (as defined in Schneider et al., 2010) via his/her main (formal) job or via secondary (formal or informal)

[32] Data from Estonian Labor Force Survey (Statistics Estonia, 2010) provide partial support: during the growth period between 2003 and 2008, the rate of non-contracted employees was fairly stable near 2% of the labor force, but felt to 1% in 2009. Nikolovova et al. (2010: Figure 10) compare the dynamics of GDP growth and two (rough) proxies of the share of informal employment in the labor force for Czech R. and Slovakia, based on LFS data for 1998-2009. The overall dynamics of informality is clearly pro-cyclic, but during the 2009 recession (for Slovakia – also during the 1999 recession) in became counter-cyclic. Note that Nikolovova et al. (2010) use small establishment size or self-employment status as proxies for informal employment, because Czech and Slovak LFS (in contrast with Estonian LFS) do not provide information on employees without legal contract.

job, let aside do-it-yourself activities, and the share of informal (at the main job) workers in the shadow output varies considerably across countries and time.

Therefore, negative association between the size of the shadow economy on one hand and GDP per capita and/or GDP growth on the other found in Schneider et al. (2010: Tables 3.1 and A.4.1) for all country groups (developing, transition, high-income/OECD, and total) does not, in principle, contradict to our results[33]. Nor do our results contradict to the "substitution effect" (positive association between short-term fluctuations in unemployment and short-term fluctuations in shadow economy) found by Bajada and Schneider (2009) for OECD countries. Rather, these results together suggest that non-contracted wage employment at the main job on one hand and undeclared earnings in general on the other follow different cyclicality patterns.

For Europe at large, as well as within Eastern and Southern Europe, both *income inequality* and proportion of *first and second generation immigrants* in population positively affect the share of informal employees (in Europe at large – also the share of informal self-employed) in the labor force. In Eastern and Southern Europe, a similar effect is found for the share of local born minority population. This is consistent with theoretical expectations (see Table 2) and available empirical evidence (on inequality: Chong and Gradstein, 2007; Perry et al., 2007; on immigrants: Ambrosini, 2001; Flaquer and Escobedo, 2009; Kahanec and Zaiceva, 2009; Kahanec et al., 2010; Diaz-Serrano, 2010; Hazans, 2011a, 2011b; Say, 2011).

Bivariate correlation between EPL strictness and prevalence of informal dependent employment is positive in Eastern and Southern Europe but negative among Western European and Nordic countries (Figure 1); yet in both country groups we find a positive impact of EPL on the share of non-contracted employees in the labor force when other factors are controlled for; this is consistent with the fact that EPL increases labor cost in the formal sector. However, in Europe at large, EPL strictness reduces informal dependent employment, other things equal. One explanation is that stricter EPL enhances attractiveness of formal jobs, and (in the pooled sample) this outweighs the effect EPL has on cost of formal labor.

Arguably, the most important distinctions between the two parts of Europe are related to the effect of the minimum wage on the share of informal dependent employment, as well as the effect of union density on the prevalence of both types of informal employment. Plausibly, this has to do with very different absolute levels of both minimum wage (e.g. in 2007, non-weighted average was €1306 for the West vs. €322 for Eastern and Southern Europe) and union density (44% vs. 19% in our samples).

[33] Schneider et al. (2010) use GDP and growth as determinants of the size of the shadow economy in some of their MIMIC models and as indicators in others, noting that "there is some arbitrariness whether to use a certain variable as causal or indicator".

Other things equal, an increase in minimum wage level relative to average wage in industry and services by a one percentage point will raise the share of dependent informal employment by 0.3 to 0.4 percentage points in Eastern and Southern Europe, as well as when all countries are pooled together; however, if only Western European and Nordic countries are considered, the same reason will lead to a reduction of the above mentioned share by 1.7 percentage points; in all three cases, the effect is highly significant[34]. Comparison with the theoretical predictions suggests that the demand side effects prevail in the first two cases, whilst the supply side channels of the impact of minimum wage level (through relative attractiveness of formal jobs and through labor force participation) prevail in Western and Northern Europe. Plausibly, the supply side effects are stronger when absolute level of minimum wage is higher. In all models, the minimum wage effects on unemployment and discouragement have the same directions as the effects on informal dependent employment.

European countries which do not have a nationwide minimum wage (this group includes the Nordic countries, the German-speaking countries, and Italy) enjoy a substantially lower share of informal dependent employment than the one predicted for them assuming the average for the region minimum-to-average wage ratio. This suggests that in the wealthy part of Europe, the demand side effects of minimum wage work through the existence of the institution as such: institutionalized minimum wage raises the demand for informal labor from formal enterprises, motivates nascent entrepreneurs to enter informal rather than formal sector or to switch from formal to informal, and makes higher the threshold to be accepted as a formal employee. This effect also appears in the best-fitting models for Europe at large (Table 6, models [4] and [6]).

In Eastern and Southern Europe, a one percentage point increase in union density reduces informal dependent (respectively, self-) employment by 0.25 (respectively, 0.4) percentage points; in Western and Northern Europe the union effect is of opposite sign (although much smaller in size). In the pooled sample, the effect is, on average, positive but small. It appears that if union density is high enough, union pressure makes formal labor more expensive relative to informal, thus increasing demand for informal labor from formal enterprises, strengthening the motivation for enterprises to become (or stay) informal, and raising the threshold for being accepted as a formal employee. However, as long as countries with low union coverage are concerned, monitoring, voice and job security seem to be the channels through which unions reduce informality.

[34] However, for Europe at large, a model where minimum wage level is interacted with union density provides a more complicated picture (see Section 5).

Contrary to the traditional (cost-based) expectations, but similarly to Fialova and O. Schneider (2011), we find that tax wedge on labor has a negative effect on the size of informal employment across European countries, as well as within Western and Northern Europe, whilst in Eastern and Southern Europe tax rates are not of primary importance in determining the level of informal employment (the effect is positive but relatively small). These results are in line with those of Friedman et al. (2000), Dreher et al. (2009) and Dreher and Schneider (2010), where tax burden has either negative or not significant effect on the size of shadow economy in big cross section of world countries. As Hibbs and Piculescu (2005) argue, the incentives to evade taxes depend not on tax rates as such but rather on net benefits from operating in the official sector; hence, when institutional quality is controlled for, the sign of the effect of fiscal burden is actually not clear. We argue that countries with high tax rates are also the countries able and willing to enforce them. Our results thus lend support to the school of thought emphasizing the institutional quality rather than fiscal burden as a key determinant of the level of shadow economic activities.

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Table 1 Prevalence of informal employment in extended labor force. Selected European countries, 2004-2009

%

Country	Data collection period	Dependent employment	Self-employment	Family workers	Total informal employment	Country	Data collection period	Dependent employment	Self-employment	Family workers	Total informal employment
Eastern Europe						*Western Europe*					
PL	2004m10-2004m11	3.4	16.2	0.6	20.2	IE	2005m2-2005m5	26.9	13.1	1.1	41.1
	2006m10-2006m11	4.3	13.1	0.2	17.6		2006m9-2007m6	25.0	14.3	1.0	40.3
	2008m11-2009m1	4.1	16.6	0.9	21.6		2009m9-2010m3	18.1	13.4	1.5	33.0
UA	2005m2-2005m2	6.2	4.0	0.4	10.6	UK	2004m10-2005m2	12.3	10.6	1.1	24.0
	2006m12-2007m1	6.7	5.9	0.5	13.1		2006m9-2006m12	10.0	10.0	0.6	20.6
	2009m3-2009m3	6.9	7.3	0.2	14.4		2008m9-2008m12	9.6	11.0	1.1	21.7
SI	2004m10-2004m11	4.5	7.3	0.8	12.6	AT	2005m1-2005m4	7.2	10.2	0.7	18.1
	2006m10-2006m11	3.4	5.9	0.6	9.9		2007m8-2007m10	8.5	9.9	1.3	19.7
	2008m10-2008m12	6.2	7.2	0.7	14.1	CH	2004m9-2005m2	1.7	11.4	0.7	13.8
BG	2006m12-2006m12	7.8	5.9	1.5	15.2		2006m9-2007m2	2.5	13.1	0.8	16.4
	2009m3-2009m4	5.3	6.7	1.2	13.2		2008m9-2009m3	1.9	11.5	0.3	13.7
CZ	2004m10-2004m12	2.2	9.0	0.7	11.9	NL	2004m9-2005m1	5.1	8.0	0.6	13.7
	2009m6-2009m7	1.3	10.7	0.5	12.5		2006m9-2007m2	4.1	7.3	0.7	12.1
SK	2004m10-2004m12	1.9	10.4	0.3	12.6		2008m9-2009m5	2.4	9.1	1.1	12.6
	2006m12-2007m2	2.2	9.3	0.1	11.6	DE	2004m9-2005m1	1.8	8.4	0.5	10.7
	2008m11-2009m2	1.2	11.0	0.0	12.2		2006m9-2007m1	1.3	9.6	0.3	11.2
RU	2006m9-2006m12	5.0	4.8	0.3	10.1		2008m9-2009m1	1.6	10.1	0.2	11.9
	2008m11-2009m3	6.1	5.4	0.5	12.0	FR	2006m10-2007m2	3.8	6.0	0.3	10.1
RO	2008m12-2009m1	5.1	5.9	0.8	11.8		2008m10-2008m12	2.7	7.1	0.5	10.3
EE	2004m10-2005m1	1.8	6.2	0.2	8.2	BE	2004m10-2005m1	2.0	9.2	1.0	12.2
	2006m11-2007m4	3.7	4.1	0.7	8.5		2006m10-2007m2	1.6	9.2	0.9	11.7
	2008m11-2009m2	3.2	6.3	0.3	9.8		2008m11-2009m2	1.6	8.4	0.5	10.5
HU	2005m4-2005m5	3.3	8.2	0.6	12.1						
	2006m11-2007m1	2.1	6.5	1.3	9.9						
	2009m2-2009m3	2.6	6.2	0.6	9.4						
LV	2007m7-2007m8	6.1	3.1	0.9	10.1						
	2009m4-2009m8	3.7	3.6	0.7	8.0						
LT	2009m10-2009m12	2.2	4.2	0.0	6.4						
Southern Europe						*Northern Europe*					
CY	2006m10-2006m12	40.6	14.5	3.3	58.4	NO	2004m9-2004m12	5.1	9.6	0.2	14.9
	2008m10-2008m12	35.2	14.5	3.3	53.0		2006m8-2006m11	5.6	9.1	0.5	15.2
GR	2005m1-2005m3	18.7	25.5	2.4	46.6		2008m8-2008m12	4.7	7.2	0.4	12.3
	2009m8-2009m11	18.2	26.2	2.3	46.7	DK	2004m10-2004m12	5.2	6.0	0.4	11.6
IL	2008m10-2009m3	25.5	10.7	0.6	36.8		2006m10-2007m2	7.9	7.3	0.1	15.3
IT	2006m2-2006m5	2.9	19.2	0.3	22.4		2008m9-2008m12	3.9	7.5	0.1	11.5
PT	2004m11-2005m3	4.0	15.6	0.2	19.8	FI	2004m9-2004m12	0.6	10.1	0.2	10.9
	2006m11-2007m2	7.6	12.8	0.4	20.8		2006m9-2006m12	0.5	9.6	0.1	10.2
	2008m11-2009m3	7.6	13.8	1.0	22.4		2008m10-2009m1	0.9	10.1	0.2	11.2
ES	2004m10-2005m1	4.1	13.1	0.5	17.7	SE	2004m10-2005m1	0.4	7.8	0.2	8.4
	2006m11-2007m2	5.1	14.4	0.9	20.4		2006m10-2007m1	0.5	7.3	0.3	8.1
	2008m9-2008m11	4.4	13.9	0.5	18.8		2008m10-2009m1	0.8	7.1	0.3	8.2

Notes: Informal self-employment includes: (i) All non-professional self-employed operating solely; (ii) Employers with 5 or fewer workers. Persons working without a contract for own family's business (family workers) are considered separately and not accounted for in the models presented in Tables 3-7. Informal dependent employment includes employees (persons in a dependent employment relationship) without a contract or who is uncertain of their contract. Labor force is extended to include all non-employed persons willing to work. Data collection period is 5% trimmed. *Source:* Calculation with ESS data.

Table 3A Macro determinants of the shares of informal employees, informal self-employed, and unemployed (incl. discouraged) in the extended labor force. Eastern and Southern Europe, 2004-2009

(seemingly unrelated regressions)

	Dependent variables (% of labor force extended to include discouraged workers)					
	Informal employees		Informal self-employed		Unemployed and discouraged	
	Estimated coefficients (robust standard errors adjusted for clustering on countries)					
	[1a]	[2a]	[1b]	[2b]	[1c]	[2c]
Employment Protection Legislation strictness, v. 2	3.129***	2.092***	3.647***	1.837*	-0.985	0.271
	(0.804)	(0.813)	(1.271)	(0.917)	(1.269)	(1.228)
Rule of Law	-13.181***		-10.178**		-3.185	
	(2.563)		(4.308)		(2.252)	
Government Effectiveness (lagged 1 year)		-5.339**		-0.056		-3.946
		(2.549)		(1.521)		(3.256)
Investment Freedom		-0.181***		-0.336***		0.046
		(0.069)		(0.055)		(0.074)
Trade Freedom		-0.074*		0.046		-0.143**
		(0.039)		(0.043)		(0.057)
Tax Wedge on low wage earners, % (lagged 1 year)	0.196*		0.128		-0.126	
	(0.106)		(0.236)		(0.142)	
Minimum Wage (% of average wage in industry & services)	0.429***	0.352***	0.356**	0.301***	0.447***	0.445***
	(0.089)	(0.082)	(0.181)	(0.081)	(0.086)	(0.071)
log GDP per capita, PPP USD (annual average, lagged 1 year)	6.643***	3.333**	7.751***	4.040***	-0.69	-0.653
	(1.636)	(1.538)	(3.005)	(1.366)	(1.282)	(1.630)
Real GDP Growth, y-o-y, quarterly data lagged 1 quarter	0.034	0.129*	0.049	0.149***	-0.124	-0.107
	(0.063)	(0.069)	(0.074)	(0.057)	(0.113)	(0.112)
Union Density, % of employees	-0.194***	-0.252***	-0.252**	-0.411***	-0.073	-0.077
	(0.052)	(0.072)	(0.114)	(0.081)	(0.050)	(0.059)
Population with immigrant background, %	0.178***	0.205***	-0.090	0.017	-0.100*	-0.122*
	(0.050)	(0.066)	(0.107)	(0.090)	(0.058)	(0.065)
Root MSE	1.8761	2.0460	3.8393	2.9874	3.6423	3.6560
R-squared	0.8135	0.7867	0.6383	0.7895	0.5080	0.5234
# obs. [# countries]	35 [14]		35 [14]		35 [14]	
Descriptive statistics on dependent variables						
Mean	5.14		9.77		12.28	
Std. Dev.	3.80		5.58		4.54	
Min	1.2		3.1		3.7	
Max	18.7		26.2		23	

Notes: Countries covered: CZ (2004, 2009); SK (2004, 2006, 2008); PL (2004, 2006, 2008); HU (2005, 2006, 2009); EE (2004, 2006, 2008); LV (2007, 2009); SI (2004, 2006, 2008); BG (2006, 2009); RO (2008); RU(2006, 2008); UA (2005, 2006, 2009); ES (2004, 2006, 2008); PT (2004, 2006, 2008); GR (2005, 2009).
See Annex 1 for details on the explanatory variables. Constant terms are not reported.
*, **, *** - coefficient is significantly different from zero at 10%, 5%, 1% level, respectively.
Sources: Dependent variables: Calculations with ESS data (see Table 1 for details). Explanatory variables - see Annex 1 (Table A1). Model estimates - own calculations (*Stata®* simultaneous estimates with clustered robust standard errors have been applied after fitting linear models by OLS).

Table 3B Macro determinants of the shares of informal employees, informal self-employed, and unemployed (incl. discouraged) in the extended labor force. Eastern and Southern EU members, 2004-2009

(seemingly unrelated regressions)

	Dependent variables (% of labor force extended to include discouraged workers)					
	Informal employees		Informal self-employed		Unemployed and discouraged	
	Estimated coefficients (robust standard errors adjusted for clustering on countries)					
	[1a]	[2a]	[1b]	[2b]	[1c]	[2c]
Employment Protection Legislation strictness, v. 2	7.717***	7.717***	6.893***	6.893***	-2.213	-2.213
	(1.073)	(1.077)	(1.811)	(1.811)	(4.666)	(4.666)
Government Effectiveness (lagged 1 year)	-1.411**	-1.411**	-2.448(*)	-2.448(*)	-3.492	-3.492
	(0.596)	(0.598)	(1.524)	(1.524)	(2.698)	(2.698)
Investment Freedom	-0.099***	-0.099***	-0.168**	-0.168**	0.025	0.025
	(0.028)	(0.028)	(0.069)	(0.069)	(0.155)	(0.155)
Trade Freedom			-0.282***	-0.282***	-0.122	-0.122
			(0.059)	(0.059)	(0.174)	(0.174)
Tax Wedge on low wage earners, % (lagged 1 year)	0.189***	0.189***	-0.270**	-0.270**	-0.325**	-0.325**
	(0.071)	(0.071)	(0.109)	(0.109)	(0.146)	(0.146)
Minimum Wage (% of average wage in industry & services); {1} assigns sample mean to IT *ITALY* (does not have a minimum wage)	0.588***	0.588***			0.512***	0.512***
	(0.052)	(0.052)			(0.168)	(0.168)
	-2.693***				4.580	
	(0.715)				(3.569)	
log GDP per capita, PPP USD (annual average, lagged 1 year)	4.823***	4.823***	8.350***	8.350***	-2.850	-2.850
	(0.504)	(0.506)	(0.962)	(0.962)	(3.372)	(3.384)
Real GDP Growth, y-o-y, quarterly data lagged 1 quarter	0.109**	0.109**	0.039	0.039	-0.186***	-0.186***
	(0.052)	(0.052)	(0.052)	(0.052)	(0.054)	(0.054)
Union Density, % of employees	-0.361**	-0.361**	-0.399***	-0.399***	0.062	0.062
	(0.035)	(0.035)	(0.058)	(0.058)	(0.122)	(0.122)
UI spending, %GDP per perc. point unempl. (lagged 1 year)	-72.23***	-72.23***	-75.73***	-75.73***	43.61	43.61
	(8.437)	(8.467)	(21.636)	(21.636)	(48.80)	(48.97)
ALMP spending, %GDP per percentage point unempl. (lagged 1 year)					-76.33*	-76.33(*)
					(46.45)	(46.61)
Minority population (native), %	0.220***	0.220***	-0.199**	-0.199**	0.006	0.006
	(0.030)	(0.031)	(0.085)	(0.085)	(0.137)	(0.137)
Population with immigrant background, %	-0.073	-0.073	0.298***	0.298***	-0.075	-0.075
	(0.055)	(0.055)	(0.116)	(0.116)	(0.259)	(0.260)
Root MSE	1.2232	1.2232	2.3602	2.4329	4.1745	4.1745
R-squared	0.9477	0.9472	0.8988	0.8988	0.5936	0.5904
# obs. [# countries]	30 [13]	29 [12]	30 [13]	29 [12]	30 [13]	29 [12]
Descriptive statistics on dependent variables						
Mean	4.92	4.99	10.89	10.60	12.58	12.50
Std. Dev.	4.09	4.15	5.89	5.78	4.71	4.77
Min	1.2	1.2	3.1	3.1	3.7	3.7
Max	18.7	18.7	26.2	26.2	23.0	23.0

Notes: Countries covered: CZ (2004, 2009); SK (2004, 2006, 2008); PL (2004, 2006, 2008); HU (2005, 2006, 2009); EE (2004, 2006, 2008); LV (2007, 2009); SI (2004, 2006, 2008); BG (2006, 2009); RO (2008); ES (2004, 2006, 2008); PT (2004, 2006, 2008); GR (2005, 2009). Models [1a], [1b], [1c] include also Italy (2006).
See Annex 1 for details on the explanatory variables. Constant terms are not reported.
(*), *, **, *** - coefficient is significantly different from zero at 11%, 10%, 5%, 1% level, respectively.
Sources: Dependent variables: Calculations with ESS data (see Table 1 for details). Explanatory variables - see Annex 1 (Table A1). Model estimates - own calculations (*Stata®* simultaneous estimates with clustered robust standard errors have been applied after fitting linear models by OLS).

Table 4 Macro determinants of the shares of informal employees in the extended labor force. Eastern and Southern Europe, 2004-2009

(*alternative panel data estimates*)

	[1]	[2]	[3]	[4]	[5]	[6]
	Prais-Winsten regressions, errors heteroscedastic, with country-specific AR1 within panels [a]			Multi-level mixed-effects linear model [b]	Population-averaged panel-data models with semi-robust SE's clustered on countries [c]	
Employment Protection Legislation strictness	1.287*	2.123***	2.075**	2.227*	2.581***	3.645***
	(0.674)	(0.775)	(0.900)	(1.198)	(0.928)	(1.123)
Rule of Law (lagged 1 yr if field work started earlier than September)					-10.513***	-9.761***
					(2.346)	(2.140)
Govt. Effectiveness (lagged 1 year)	-6.571***	-5.357***	-5.419***	-1.949*		
	(2.193)	(1.845)	(1.828)	(1.061)		
Investment Freedom	-0.222***	-0.215***	-0.213***	-0.135***		
	(0.052)	(0.044)	(0.043)	(0.044)		
Trade Freedom	-0.058*	-0.066**	-0.061**			
	(0.032)	(0.027)	(0.025)			
Tax Wedge for low wage earners, % (lagged 1 yr)			-0.025		0.088	
			(0.120)		(0.113)	
Implicit tax rate on labor income, %						0.189**
						(0.088)
Minimum Wage (% of average wage in industry & services)	0.383***	0.359***	0.359***	0.203***	0.377***	0.488***
	(0.048)	(0.051)	(0.050)	(0.071)	(0.111)	(0.165)
log GDP per capita, PPP USD (annual average, lagged 1 year)	4.571***	3.441***	3.475***	0.465	5.594***	4.605***
	(1.046)	(0.995)	(1.000)	(0.469)	(1.905)	(1.551)
Real GDP Growth y-o-y (previous quarter)	0.214***	0.136**	0.132**	0.078*	0.047	0.035
	(0.039)	(0.057)	(0.064)	(0.042)	(0.058)	(0.066)
Union Density, % of employees	-0.303***	-0.297***	-0.295***	-0.190***	-0.117**	-0.177**
	(0.049)	(0.044)	(0.048)	(0.061)	(0.051)	(0.072)
IMMIGR: % pop. with immigrant background	0.310***	0.194***	0.194***	0.193	0.166**	0.139***
	(0.031)	(0.054)	(0.057)	(0.128)	(0.065)	(0.052)
Country random-effects						
sd(beta[*IMMIGR*])				0.201		
sd(u_i)				1.345		
Residuals: sd(e_{it}), East				1.086		
Residuals: sd(e_{it}), South				1.786		
LR test vs. a model without random effects				Prob > chi2 = 0.0035		
Root MSE	1.8553	1.6659	1.6744	0.9660	1.9891	1.9296
R-squared	0.9275	0.9140	0.9154			
# obs. [# countries]	37 [16]	35 [14]	35 [14]	35 [14]	35 [14]	30 [12]

Notes: Countries covered: For models [2] – [5], see Notes to Table 3A. Model [1] covers also Israel (2008) and Lithuania (2009). Model [6] excludes Russia and Ukraine. Models [2] – [6] include at least 2 observations for each country but Romania. See Annex 1 for details on the explanatory variables. Constant terms are not reported. [a] See Davison and MacKinnon (1993): 343-351; Beck and Katz (1995). [b] See Greene (2008): 233-238. [c] See Liang and Zeger (1986); Zeger et al. (1988). Results are obtained by averaging random effects across population. Models [5] and [6] assume all off-diagonal error correlations within panels to be equal (estimated rho: 0.429 in [5] and 0.153 in [6]). Random effects in [4]-[6] may correlate with explanatory variables. *, **, *** - coefficient is significantly different from zero at 10%, 5%, 1% level.

Sources: Model estimates - own calculations. Dependent and explanatory variables: See Table 1 and Table A1.

Table 4 Macro Determinants of the Shares of Informal employees in the Extended Labor Force. Eastern and Southern Europe, 2004-2009

(*alternative panel data estimates, continued*)

	[7]	[8]	[9]	[10]	[11]	[12]
	Population-averaged panel-data models (semi-robust standard errors clustered on countries in parentheses)					
Employment Protection Legislation strictness, v. 2	3.138***	3.387***	3.343***	3.426***	4.302***	3.216***
	(0.571)	(0.647)	(0.749)	(0.820)	(0.469)	(0.683)
Govt. Effectiveness [a] (Rule of Law in [11]) [a]	-5.097***	-4.401***	-4.301***	-4.003***	-3.397***	-2.926*
	(1.442)	(1.693)	(1.674)	(1.350)	(1.237)	(1.562)
Investment Freedom [a]	-0.043*	-0.063***	-0.065**	-0.056***		
	(0.023)	(0.026)	(0.025)	(0.020)		
Tax Wedge for low wage earners, % [a]					0.268***	0.112*
					(0.049)	(0.059)
Implicit Tax Rate on Labor income, % [a]	0.300***	0.420***	0.413***	0.334***		
	(0.081)	(0.087)	(0.090)	(0.075)		
MINWAGE: Minimum wage (% of average wage in industry & services); [7] & [8] assign to Italy sample mean(*MINWAGE*)	0.643***	0.561***	0.555***	0.627***	0.492***	0.498***
	(0.041)	(0.039)	(0.041)	(0.059)	(0.060)	(0.060)
ITALY (does not have a minimum wage)	-7.727***	-10.181***				
	(1.646)	(2.129)				
log GDP per capita, PPP USD (annual average) [a]	5.787***	7.186***	7.155***	4.991***	2.023**	1.405
	(1.069)	(1.102)	(1.116)	(1.095)	(0.926)	(1.076)
Real GDP Growth y-o-y (previous quarter)	0.237***	0.271***	0.266***	0.248***	0.140***	0.181***
	(0.064)	(0.094)	(0.094)	(0.081)	(0.035)	(0.034)
Union Density, % of employees	-0.203***	-0.253***	-0.250***	-0.258***	-0.323***	-0.225***
	(0.020)	(0.043)	(0.046)	(0.041)	(0.030)	(0.032)
ALMP spending, %GDP per percentage point unempl. [a]	-71.283***			-68.893***		
	(4.297)			(9.209)		
UI spending, %GDP per percentage point unempl. [a]		-40.164***	-40.093***			
		(4.239)	(4.838)			
UBSA: Average unempl. benefit and social assistance net replacement rate over 60 months of unemployment, % [a]					-0.845***	-0.719***
					(0.098)	(0.105)
UBSA-squared/100					0.776***	0.625***
					(0.101)	(0.098)
Gini index [a]	0.199***	0.386***	0.383***	0.226**		
	(0.063)	(0.086)	(0.098)	(0.104)		
Minority population (native), %	0.218***	0.268***	0.269***	0.252***		
	(0.022)	(0.032)	(0.035)	(0.037)		
Root MSE	1.657	1.694	1.704	1.614	1.048	1.240
# obs. [# countries]	31 [14]	30 [14]	29 [13]	29 [13]	27 [12]	27 [12]
Obs. per country, min/avg./max	1/2.2/3	1/2.1/3	1/2.2/3	1/2.2/3	1/2.3/3	1/2.3/3

Notes: Constant terms are not reported. Countries covered: Model [7]: CZ (2004, 2009); SK (2006, 2008); PL (2004, 2006, 2008); HU (2005, 2006, 2009); EE (2004, 2006, 2008); LV (2007, 2009); LT(2009); SI (2004, 2006, 2008); BG (2006, 2009); RO (2008); ES (2004, 2006, 2008); PT (2004, 2006, 2008); IT (2006); GR (2005, 2009). Model [8] excludes SI (2004). Models [9]-[10] exclude also IT. Models [11]-[12] exclude also EE (2004), LT (2009), and BG (2006), but include SK (2004). [a] Lagged 1 year.

Sources: Dependent variables: Calculations with ESS data (see Table 1 for details). Explanatory variables - see Annex 1 (Table A1). Model estimates - own calculations.

Table 5 Macro determinants of the shares of informal employees, informal self-employed, and unemployed (incl. discouraged) in the extended labor force. Western and Northern Europe, 2004-2009 *(seemingly unrelated regressions)*

	Informal employees		Informal self-employed		Unemployed and discouraged	
	(% of labor force extended to include discouraged workers)					
	Estimated coefficients (robust standard errors clustered on countries)					
	[1a]	[2a]	[1b]	[2b]	[1c]	[2c]
Employment Protection Legislation Strictness, v. 2	7.651**	7.140***	-1.298**	-0.788	5.165***	5.604***
	(3.860)	(2.388)	(0.620)	(0.597)	(1.243)	(1.491)
Government Effectiveness ([1a]: instrumented, see Annex 2)	-6.200**		-2.000**		-2.551	
	(3.028)		(1.074)		(1.771)	
Satisfaction with the Govt. ([2c]: instrumented, see Annex 2)		-2.609***		-0.274		-0.362
		(0.681)		(0.191)		(0.671)
(Government Expenditures as % of GDP), squared /100		-0.161	-0.252***	-0.305***	-0.179***	-0.245***
		(0.104)	(0.052)	(0.055)	(0.068)	(0.084)
Business Freedom	-0.119**		-0.042***		-0.038	
	(0.051)		(0.015)		(0.032)	
Monetary Freedom (lagged 1 year)		-0.394***		-0.030		0.024
		(0.126)		(0.073)		(0.157)
Tax Wedge for low wage earners, % (lagged 1 year)	-0.742***	-0.764***	-0.072*	-0.062	-0.115**	-0.089
	(0.213)	(0.111)	(0.039)	(0.048)	(0.053)	(0.061)
Minimum Wage (% of average wage in industry & services) [a]	-1.720**	-1.471***	0.182*	0.144	-0.829***	-0.842**
	(0.674)	(0.395)	(0.103)	(0.112)	(0.292)	(0.376)
NO_MINWAGE: the country does not have a minimum wage	-2.468*	-0.890	1.058***	1.049**	-0.692	-0.991
	(1.526)	(1.167)	(0.320)	(0.534)	(0.679)	(0.871)
log GDP per capita, PPP USD (annual average, lagged 1 year)	-2.854	-8.352**	-2.855**	-4.309***	-19.053***	-19.977***
	(6.385)	(4.178)	(1.276)	(1.509)	(2.402)	(2.317)
Real GDP Growth, y-o-y, quarterly data lagged 1 quarter	0.094	0.447***	0.071	0.087	-0.505***	-0.496***
	(0.113)	(0.162)	(0.074)	(0.070)	(0.064)	(0.104)
LMP_ACTIVE: Active labor market measures spending, % GDP per percentage point of unemployment (lagged 1 yr)			-7.158***	-6.865***	-26.202***	-26.165***
			(2.487)	(2.077)	(5.626)	(6.533)
LMP_PASSIVE: Defined in the same way as *LMP_ACTIVE*	23.538***	25.798***			18.609***	17.967***
	(8.589)	(4.380)			(5.178)	(5.670)
UBSA (defined in Table 4), lagged 1 year	-0.488***	-0.416***				
	(0.141)	(0.074)				
Union Density, % of employees	0.078**	0.091***	0.032***	0.031***	0.114***	0.112***
	(0.037)	(0.023)	(0.009)	(0.010)	(0.017)	(0.021)
Population with Immigrant Background, %	0.057	0.098	0.009	0.037	0.438***	0.458***
	(0.184)	(0.104)	(0.036)	(0.040)	(0.091)	(0.085)
Root MSE	1.5150	1.8328	0.8655	0.9444	1.774	1.834
R-squared	0.8937	0.9518	0.8912	0.8704	0.8462	0.8356
# obs. [# countries]	34 [12]		34 [12]		34 [12]	
Descriptive statistics on dependent variables						
Mean	5.52		9.40		7.47	
Std. Dev.	6.50		2.09		3.52	
Min	0.4		6.0		2.6	
Max	26.9		14.3		18.8	

Notes: Countries covered: (A) with a national minimum wage: FR, BE, UK, IE NL; (B) without a national minimum wage: AT, CH, DE, DK, FI, NO, SE. [a] Countries without a minimum wage assigned sample mean. *, **, *** - coefficient is significantly different from zero at 10%, 5%, 1% level, respectively.

Sources: Dependent variables: Calculations with ESS data (see Table 1 for details). Explanatory variables - see Annex 1 (Table A1). Model estimates - own calculations (*Stata®* simultaneous estimates with clustered robust standard errors have been applied after fitting linear models by OLS).

Table 6 Macro determinants of the shares of informal employees in the extended labor force. Western European and Nordic countries and Europe at large, 2004-2009

(*alternative panel data estimates)*

	Western and Northern Europe			Europe (all regions)		
	[1]	[2]	[3]	[4]	[5]	[6]
Employment Protection Legislation Strictness, v. 2	2.174*	7.998***	0.936	-2.652***	-1.551	-1.813
	(1.274)	(0.693)	(2.082)	(0.898)	(0.960)	(1.309)
Government effectiveness (in [3] – [6] lagged 1 year)	-8.207***	-12.765***	-4.645**	-5.355***	-3.922**	-1.985
	(2.010)	(0.892)	(2.350)	(1.457)	(1.575)	(1.211)
Business Freedom	-0.117***	-0.191***	-0.063**	-0.072**	-0.066**	-0.037
	(0.024)	(0.038)	(0.032)	(0.030)	(0.026)	(0.028)
Tax Wedge on low wage earners, % (lagged 1 year)	-0.684***	-0.801***	-0.541***	-0.611***	-0.517***	-0.400***
	(0.093)	(0.032)	(0.163)	(0.067)	(0.087)	(0.108)
MINWAGE: minimum wage (% of average wage in industry & services)	-0.609**	-1.849***	-0.661**	0.372***	0.253***	0.401**
	(0.246)	(0.107)	(0.311)	(0.072)	(0.094)	(0.170)
*MINWAGE*UNION_DENSITY*						-0.013*
						(0.007)
UNION_DENSITY, % of employees	0.074***	0.127***	0.045	0.058***	0.012	0.536*
	(0.022)	(0.006)	(0.049)	(0.020)	(0.029)	(0.279)
NO_MINWAGE: the country does not have a minimum wage	-0.165	-1.817***	-2.557	-2.764***	-1.353	-3.790*
	(0.452)	(0.343)	(2.353)	(1.059)	(1.759)	(2.295)
lnGDP_ per_capita, PPP USD (annual average, lagged 1 year)	-4.959	-3.085**	-1.254	4.108***	3.419***	5.169***
	(3.275)	(1.473)	(6.094)	(1.058)	(1.293)	(1.382)
IMMIGR log_GDP per capita*						-0.219**
						(0.093)
IMMIGR: Population with immigrant background, %	-0.310***	0.124***	-0.103	0.081*	0.060	1.950**
	(0.077)	(0.046)	(0.132)	(0.046)	(0.072)	(0.859)
Real GDP growth, y-o-y, quarterly data lagged 1 quarter	0.279***	0.286**	0.185**	0.092	0.131***	0.132***
	(0.039)	(0.114)	(0.084)	(0.057)	(0.046)	(0.043)
LMP_PASSIVE: Passive labor market measures spending, % GDP per percentage point of unemployment (lagged 1 yr)	9.253**	28.345***	12.591*			
	(4.368)	(0.755)	(7.748)			
UBSA (defined in Table 4), lagged 1 year	-0.301***	-0.481***	-0.342***			
	(0.047)	(0.053)	(0.104)			
Gini index (lagged 1 year)				0.262***	0.119	
				(0.068)	(0.116)	
Country-level random eff. s.d.			3.066			3.191
Residual s.d.			0.918			1.278
LR test vs. a model without random effects, *p*-value			0.0001			0.0000
Root MSE	0.8500	1.2822	0.6209	2.1074	2.7608	0.9271
R-squared	0.9788			0.8645		
# obs. [# countries]	34 [12]	34 [12]	34 [12]	67 [27]	67 [27]	67 [27]

Notes: [1] and [4] are Prais-Winsten regressions (See Davidson and MacKinnon (1993): 343-351) with country level heteroscedasticity and country-specific AR1 error correlation within panels. [2] and [5] are population-averaged panel-data models with semi-robust SE's clustered on countries (see Zeger et al., 1988); in these models, the estimates are obtained by averaging country-level random effects (possibly correlated with the Xs) across population. [3] and [6] are mixed-effects linear models with country-level random effects (possibly correlated with the Xs), see Section 2 and Greene (2008: 233-238) for details. Countries covered: For models [1] – [3], see Notes to Table 5. For models [4] – [6]: EU-27 (except for Cyprus, Luxembourg, and Malta), Norway, Russia, and Ukraine. *, **, *** - estimates significant at 10%, 5%, 1% level, respectively.

Sources: Dependent variables: Calculations with ESS data (see Table 1 for details). Explanatory variables - see Annex 1 (Table A1). Model estimates - own calculations.

Table 7 Macro determinants of the shares of informal employees, informal self-employed, and unemployed (incl. discouraged) in the extended labor force. Europe, 2004-2009

(*seemingly unrelated regressions*)

	Informal employees		Informal self-employed		Unemployed and discouraged	
	(% of labor force extended to include discouraged workers)					
	Estimated coefficients (robust standard errors clustered on countries)					
	[1a]	[2a]	[1b]	[2b]	[1c]	[2c]
Employment Protection Legislation Strictness, v. 2	-2.673***	-2.887***	0.843	1.197	-1.120	-1.753***
	(0.948)	(0.819)	(0.903)	(0.934)	(0.728)	(0.674)
Government effectiveness ([1b], [2b]: instrumented, see Annex 2)	-5.059***	-5.676***	1.459	8.212*	-2.815***	-3.895**
	(1.901)	(2.153)	(3.068)	(4.881)	(1.369)	(1.706)
Business Freedom	-0.075**	-0.086***	-0.148***	-0.109**	0.004	-0.070**
	(0.034)	(0.032)	(0.053)	(0.049)	(0.051)	(0.032)
Tax Wedge on low wage earners, % (lagged 1 year)	-0.552***	-0.577***	-0.212***	-0.201**	-0.020	-0.138**
	(0.079)	(0.075)	(0.081)	(0.089)	(0.073)	(0.055)
Minimum Wage (% of average wage in industry & services)	0.354***	0.367**	0.253(*)	0.311	0.453***	0.587***
	(0.095)	(0.168)	(0.160)	(0.257)	(0.088)	(0.156)
NO_MINWAGE: the country does not have a minimum wage	1.092	1.130	1.394	0.640	1.705	2.235
	(1.562)	(1.642)	(1.598)	(1.302)	(1.681)	(1.514)
log GDP per capita, PPP USD (annual average, lagged 1 year)	3.633***	3.221**	1.828	0.544	-1.519	-1.791
	(1.265)	(1.303)	(1.786)	(2.282)	(0.984)	(1.173)
Real GDP growth, y-o-y, quarterly data lagged 1 quarter	0.114***	0.117*	0.067	0.119**	-0.145(*)	-0.226***
	(0.050)	(0.060)	(0.076)	(0.064)	(0.089)	(0.060)
LMP_ACTIVE: Active labor market measures spending, % GDP per percentage point of unemployment (lagged 1 yr)				-33.216***		-41.139***
				(12.587)		(8.886)
LMP_PASSIVE: Defined in the same way as *LMP_ACTIVE*		6.522				19.365***
		(5.148)				(6.434)
Union Density, % of employees	0.016	0.012	-0.047**	-0.060*	-0.021	0.029
	(0.024)	(0.028)	(0.018)	(0.036)	(0.028)	(0.028)
Population with Immigrant Background, %	0.149***	0.185***	-0.176**	-0.348***	-0.087	0.039
	(0.050)	(0.057)	(0.074)	(0.118)	(0.063)	(0.064)
Gini index (lagged 1 yr)	0.174(*)	0.172(*)	0.292**	0.460***	0.200(*)	0.033
	(0.108)	(0.106)	(0.169)	(0.171)	(0.122)	(0.125)
Root MSE	2.9717	3.1089	3.5521	3.3192	3.2598	2.8376
R-squared	0.7384	0.7493	0.4693	0.5616	0.5912	0.7235
# obs. [# countries]	67 [27]	61 [25]	67 [27]	61 [25]	67 [27]	61 [25]
	Descriptive statistics on dependent variables					
Mean	5.45	5.40	9.53	9.90	10.23	10.13
Std. Dev.	5.30	5.55	4.45	4.48	4.65	4.78
Min	0.40	0.40	3.10	3.10	2.60	2.60
Max	26.90	26.90	26.20	26.20	23.00	23.00

Notes: Countries covered: Models [1a], [1b], [1c]: EU-27 (except for Cyprus, Luxembourg, and Malta), Norway, Russia, and Ukraine. Models [2a], [2b], [2c] exclude Russia, Ukraine and the 2004 observation on Slovenia.
(*), *, **, *** - estimates significant at 11%, 10%, 5%, 1% level, respectively.

Sources: Dependent variables: Calculations with ESS data (see Table 1 for details). Explanatory variables - see Annex 1 (Table A1). Model estimates - own calculations.

Table 8 Tax wedge and implicit tax rate on labor income as determinants of proportion of population expecting some punishment (fine or prison) for a person whose undeclared economic activity is detected. 20 EU countries, 2007

	Estimated coefficients (robust standard errors)					
	[1]	[2]	[3]	[4]	[5]	[6]
Tax Wedge on low wage earners, % (lagged 1 year) [a]	0.923***	1.236***	1.127***			
	(0.280)	(0.235)	(0.212)			
Implicit tax rate on labor income, % (lagged 1 year) [a]				1.432***	1.657***	1.362***
				(0.527)	(0.423)	(0.411)
Employment Protection Legislation strictness, v. 2		-10.410***	-7.934***		-8.117*	-5.760(*)
		(3.317)	(2.466)		(4.186)	(3.368)
Rule of Law (lagged 1 year) [a]			11.160***			8.782**
			(3.457)			(3.669)
R-squared	0.2652	0.4013	0.6338	0.3580	0.4503	0.5823
N	20	20	20	20	20	20

Notes: See Annex 1 (Table A1) for details on explanatory variables. Constant terms are not reported. Countries covered: AT, BE, BG, DE, DK, EE, ES, FI, FR, HU, IE, IT, LV, NL, PL, PT, SE, SI, SK, UK.
(*), *, **, *** - estimates significant at 11%, 10%, 5%, 1% level, respectively.
Sources: Dependent variable: Riedmann and Fischer (2008), based on *Special Eurobarometer* 284. Explanatory variables - see Annex 1 (Table A1). Model estimates - own calculations.

Table 9 Effects of macro factors on informal employment and unemployment in Europe (2004-2009), by country group
(Standardized coefficients from seemingly unrelated regressions with robust std. errors clustered on countries)

	Employees without legal contract				*Informal self-employed*				*Unemployed and discouraged*			
	(y = % of labor force extended to include discouraged workers)											
	E & S	W & N [d]	EUR27	EUR25	E & S	W & N	EUR27 [d]	EUR25 [d]	E & S	W & N	EUR27	EUR25
EPL_2	0.98***	4.00**	-1.36***	-1.53***	0.86*	-0.68**	0.41	0.65	0.13	2.70***	-0.57	-0.93***
GOV_EFFECT [a]	-3.17**	-1.62**	-3.70***	-3.31***	-0.03	-0.52**	1.07	4.80*	-2.34	-0.67	-2.06***	-2.27***
GOV_EXPsq/100						-1.56***				-1.11***		
INVEST_FREE	-3.05***				-5.65***				0.77			
TRADE_FREE	-0.68*				0.42				-1.30**			
BUS_FREE		-1.12**	-0.98**	-0.92***		-0.39***	-1.94***	-1.17**		-0.36	0.05	-0.75**
TAX_WEDGE [b]		-6.81***	-3.66***	-3.93***		-0.66*	-1.40***	-1.37**		-1.05**	-0.13	-0.94**
MIN_WAGE	2.73***	-4.50**	2.32***	1.50**	2.34***	0.47*	1.66(*)	1.27	3.46***	-2.17***	2.97***	2.40***
NO_MINWAGE		-2.47*	1.09	1.13		1.06***	1.39	0.64		-0.69	1.71	2.24
logGDP_PC [b]	2.60**	-0.49	3.52***	2.51**	3.15***	-0.49**	1.77	0.42	-0.51	-3.26***	-1.47	-1.40
GROWTH	0.77*	0.23	0.58***	0.58*	0.89***	0.17	0.34	0.58**	-0.64	-1.23***	-0.73(*)	-1.11***
UNION	-2.60***	1.96***	0.36	0.28	-4.24***	0.81***	-1.06**	-1.41*	-0.79	2.85***		0.69
LMP_ACTIVE [b]						-0.53***		-2.80***		-1.92***		-3.47***
LMP_PASSIVE [b]		2.71***		0.82						2.14***		2.42***
UBSA [b]		-3.04***										
GINI [b]			0.86(*)	0.79(*)			1.44**	2.12***			0.99(*)	0.15
IMMIGR	1.57***	0.12	0.91***	1.17***	0.13	0.05	-1.07**	-2.20***	-0.94*	2.42***	-0.53	0.25
Root MSE	2.05	1.51	2.97	3.11	2.99	0.87	3.27	3.09	3.66	1.77	3.26	2.84
R-squared (OLS)	0.7867	0.8937	0.7384	0.7493	0.7895	0.8912	0.5490	0.6280	0.5234	0.8462	0.5912	0.7235
N [# countries]	35 [14]	34 [12]	67 [27]	61 [25]	35 [14]	34 [12]	67 [27]	61 [25]	35 [14]	34 [12]	67 [27]	61 [25]
Table [model]	3 [2a]	5 [1a]	7 [1a]	7 [2a]	3 [2b]	5 [1b]	7 [1b]	7 [2b]	3 [2c]	5 [1b]	7 [1b]	7 [2b]

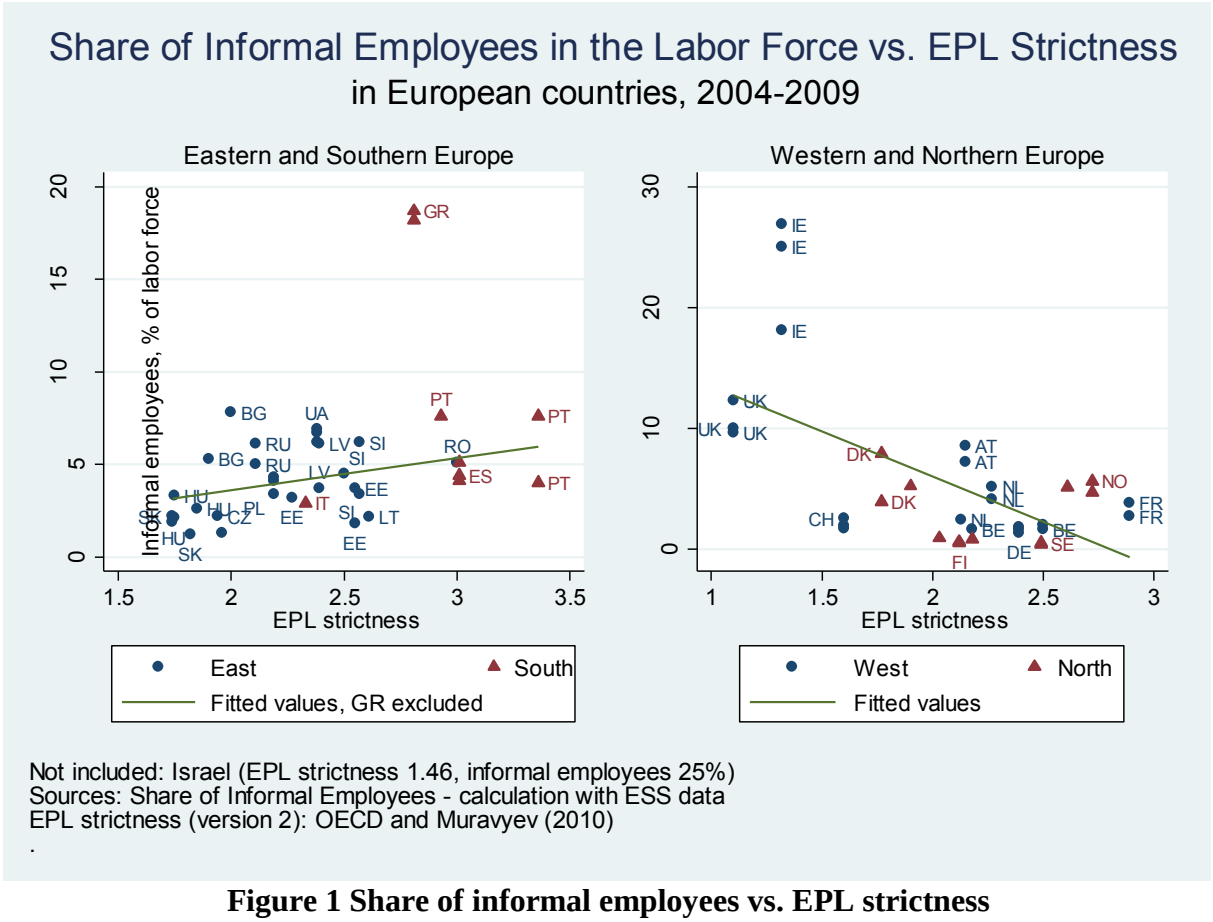
Notes: Reported is change in y caused by a 1 std. deviation change in x. E, S, W, N – Eastern, Southern, Western and Northern Europe, respectively; EUR25 includes all EU27 countries (except CY, MT, and LU), as well as NO; EUR27 (as well as E & S) includes also RU and UA; W & N includes CH (which is absent in EUR 27). IT (2006) and LT(2009) are included in EUR25/27 but excluded from E & S. See Tables 3B and 4 for (non-standardized) results for E & S with labor market spending variables.
[a] (respectively, [b]) – variable is lagged 1 year in E & S (respectively, all) models. Non-standardized coefficients reported for dummy *NO_MINWAGE*.
[c] Models in which *GOV_EFFECT* is instrumented (see Annex 2). (*), *, **, *** - estimates significant at 11%, 10%, 5%, 1% level, respectively.
See Annex 1 for details on the explanatory variables. *Sources:* Own calculation.

Table 10 Signs of the effects of macro factors on the share of informal employment in the labor force, by country group and study

Source	This study						Fialova and Schneider, 2011							Perry et al., 2007		Loayza et al. 2009		Loayza/Rigolini 2006	
Dependent var. (% labor force)	Employees without legal contract			Informal self-employed			No pension contribution	No legal contract or temporary contract			Self-employed (S/E)			No pension contribution	S/E	No pension contribution	S/E	Self-employed	
Coverage	E&S	W&N	EUR	E&S	W&N	EUR	EUR17	EUR25	W&N&S	E	EUR25	W&N&S	E	World		World		World	DC
# countries	14	12	27	14	12	27	17	25	16	9	25	16	9	60	60	70	57	42	18
# obs	35	34	67	35	34	67	17	49	31	18	49	31	18	60	60	70	57	525	205
EPL_2	+	+	–	+	–	0	+	+	+	+	+	+	0						
GOV_EFFECT	– [a]	– [a]	–	0 [a]	– [a]	+								0 [a]	– [a]				
GOV_EXPsq		(–) [b]			–													0	–
REG_QUAL							+	0	0	0	–	+	0						
CORR_CONTR							–	+	+	0	–	–	0	– [b]	– [b]				
SAT_GOV		– [b]			(–) [b]														
RULE_LAW	– [b]			– [b]										– [c]	– [c]	–	–	–	–
INVEST_FREE	– [a]			– [a]															
TRADE_FREE	– [a]			0 [a]															
BUS_FREE		– [a]	–		– [a]	–	0	0	+	–	0	0	0		–	–	–	–	–
MON_FREE		– [b]			0 [b]														
FIS_FREE							–	–	0	–	–	+	0						
TAX_WEDGE	+ [b]	–	–	0 [b]	–	–	–	–	0	0	–	–	0						
TAX_RATE	+[c,d]																		
MIN_WAGE	+	–	+	+	+	+	0	0	0	+	0	0	0						
NO_MINWAGE	–	–	–		+	0													
GDP_PC	+	–	+	+	–	0	+	0	0	0	+	–	0	–	–			–	–
GROWTH	+	+	+	+	0	+													
UNION	–	+	+	–	+	–	+	–	–	–	+	+	0						
LMP_ACTIVE	– [c]				–	– [a]	–	0	0	0	–	0	0						
LMP_PASSIVE	– [d]	+	0 [a]			0 [a]	+	0	0	0	+	0	0						
UBSA		–																	
GINI	+[c,d]		+			+								+ [d]					
MINORITY	+[c,d]																		
IMMIGR	+[a,b]	0	+	0	0	–													

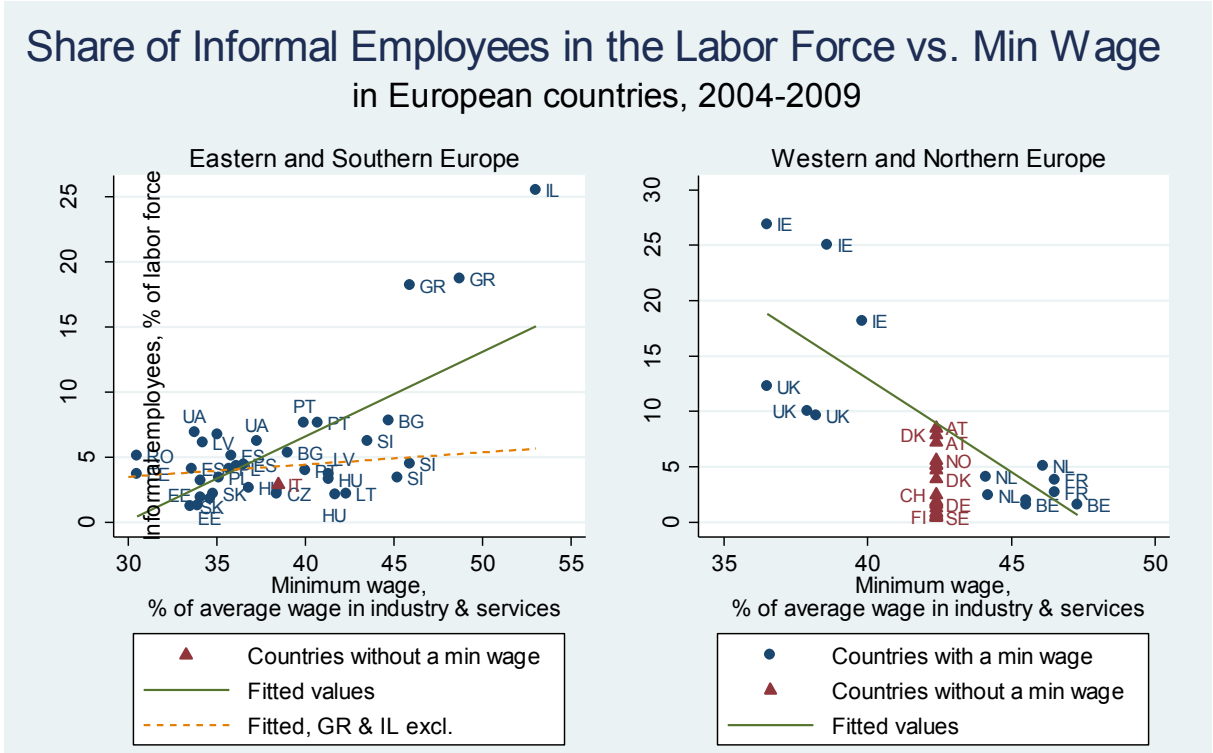
Notes: For the coverage, the following notation is used: E, S, W, N –Eastern, Southern, Western and Northern Europe, respectively; EUR – Europe (countries as in Table 1, excl. Cyprus, Israel, and Switzerland); EUR17 – 11 „old Europe" countries and 6 NMS; EUR25 – same as EUR, excl. Russia and Ukraine; DC –developing countries. Explanatory variables: *REG_QUAL* and *CORR_CONTR* – indicators of Regulatory Quality and Control of Corruption, respectively, from the Worldwide Governance Indicators (see Kaufmann et al. 2010; World Bank 2010); *FIS_FREE* (Fiscal Freedom) - the Heritage Foundation (2010) measure of the tax burden, which is inversely related to top tax rates and to tax revenue. Other variables – see Table A1. Loayza et al. and Loayza/Rigolini use other versions of *RULE_LAW* and *BUS_FREE*; Loayza et al. control also for average years of

schooling and shares of youth and rural population. Shaded cells indicate results which might be spurious due to correlation between the variables involved. In each column, letters indicate alternative specifications; entries without letters refer to variables common to all specifications. Zero refers to a variable insignificant in every specification (within column).



Not included: Israel (EPL strictness 1.46, informal employees 25%)
Sources: Share of Informal Employees - calculation with ESS data
EPL strictness (version 2): OECD and Muravyev (2010)
.

Figure 1 Share of informal employees vs. EPL strictness



Some country labels are omitted
Not included: Russia (min wage 9% & 13%, informal employees 5% & 6%)
Not included: Cyprus (no min wage, informal employees 35% & 41%)

Figure 2 Share of informal employees vs. minimum wage level

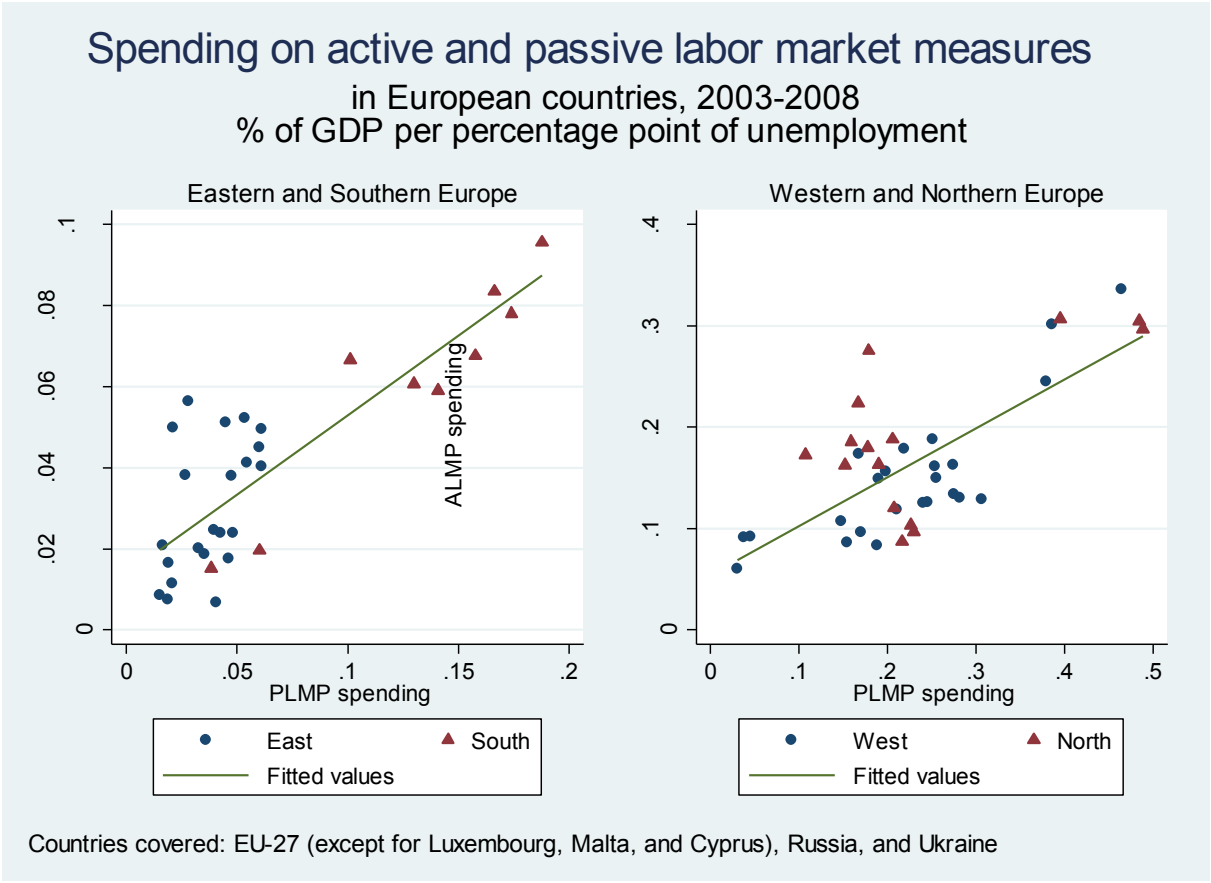


Figure 3 Spending on active and passive labor market measures

Annex 1 Explanatory variables

Table A1. Explanatory variables used in the analysis – definitions and data sources

Name	***Abbreviation***	***Source*** [c]	***Description***	***Scale***
Employment protection legislation strictness	*EPL_2*	OECD and Muravyev (2010).	Employment protection legislation index, version 2.	0 to 6, higher = more rigid
Government Effectiveness [b]	*GOV_EFFECT*	World Governance Indicators (Kaufmann et al. 2010; World Bank 2010)	Captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.	-2.5 to 2.5, higher = more efficient
Rule of Law [b]	*RULE_LAW*	World Governance Indicators (Kaufmann et al. 2010; World Bank 2010)	Captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	-2.5 to 2.5, higher = better law enforcement
Satisfaction with the Government	*SAT_GOV*	European Social Survey (2002-2009), own calculation	Average satisfaction with the national government	0 to 10, higher = more satisfied
Government expenditures	*GOV_EXPsq*	Heritage Foundation (2010), own calculation	Government expenditures (consumption and transfers) at all levels as percentage of GDP, squared /100. Recalculated from the Heritage Foundation (2010) Government Spending index: the latter equals 100 – 3×GOV_EXPsq	0 to 33, higher = higher spending
Investment Freedom [b]	*INVEST_FREE*	Heritage Foundation (2010)	Evaluates a variety of restrictions typically imposed on investment (labor market regulations are not included in this index).	0 to 100, higher = less restrictions
Trade Freedom	*TRADE_FREE*	Heritage Foundation (2010)	A composite measure of the absence of tariff and non-tariff barriers that affect imports and exports of goods and services	0 to 100, higher = less barriers
Business Freedom	*BUS_FREE*	Heritage Foundation (2010)	Measures the ability to start, operate, and close a business	0 to 100, higher = less burdensome regulation
Monetary Freedom [a]	*MON_FREE*	Heritage Foundation (2010)	Measures price stability and absence of price controls; negatively related to the square root of exponentially weighted average inflation rate for the most recent three years; in addition, countries with price controls are penalized.	0 to 100, higher = lower inflation and less price controls
Tax wedge for low wage earners [a]	*TAX_WEDGE*	Eurostat and IZA database described by Lehmann and Muravyev (2009)	Income tax on gross wage earnings plus the employee's and the employer's social security contributions, expressed as a percentage of the total labor costs of the earner, which include gross earnings plus the employer's social security contributions plus payroll taxes (where applicable).	0 to 100, higher = larger tax burden
Implicit tax rate on labor [a]	*TAX_RATE*	Eurostat	Total tax rate on labor computed as the ratio of total tax revenues of the category labor to a proxy of the potential tax base defined using the production and income accounts of the national accounts.	0 to 100, higher = larger tax burden

Notes: [a] Lagged 1 year in all specifications where used. [b] Lagged 1 year in some specifications.
[c] In few cases, data on the closest available year or interpolation have been used to fill missing data. Relevant related data have been analyzed in these cases to assure validity of the procedure.

Table A1. Explanatory variables used in the analysis – definitions and data sources

(continued)

Name	***Abbreviation***	***Source*** [c]	***Description***	***Scale***
Minimum wage level	*MIN_WAGE0, MIN_WAGE*	Eurostat and own calculations with data of national statistical offices of Russia and Ukraine	*MIN_WAGE0:* Minimum wage level expressed as percentage of average wage in industry and services. *MIN_WAGE* assigns countries without a minimum wage sample mean of *MIN_WAGE0* (in addition, a dummy *NO_MINWAGE* for these countries is included in the models).	0 to 100
No minimum wage	*NO_MINWAGE*	Eurostat	= 1 if a country does not have a minimum wage, 0 otherwise	0 or 1
Union density	*UNION*	Calculation with ESS data	Trade union membership, share of all employees (%).	0 to 100
GDP per capita [a]	*GDP_PC*	World Bank	Logarithm of GDP per capita, purchasing power parities	6.8 to 10.7
GDP growth [d]	*GROWTH*	Eurostat, OECD, statistical offices of Russia and Ukraine, and own calculations	Real year-on-year GDP growth (quarterly data), %	-50 to 20
Population with immigrant background	*IMMIGR*	Calculation with ESS data	First generation immigrants and second generation immigrants	0 to 100
Minority population	*MINORITY*	Calculation with ESS data	Local born minority population without immigrant background, %	0 to 100
Gini index [a]	*GINI*	Eurostat and World Bank	Gini index of income inequality	0 to 100
Active labor market policy expenditure [a]	*LMP_ACTIVE*	Calculation with OECD and Eurostat data	Active labor market measures spending (categories 20-70), % GDP per percentage point of (LFS-based) unemployment	0 to 1
Passive labor market policy expenditure [a]	*LMP_PASSIVE*	Calculation with OECD and Eurostat data	Passive labor market measures spending (categories 80-90), % GDP per percentage point of (LFS-based) unemployment	0 to 1
Benefit net replacement rate for long-term unemployed [a]	*UBSA*	OECD	Average unemployment benefit and social assistance net replacement rate over 60 months of unemployment (%)	0 to 100

Notes: [a] Lagged 1 year in all specifications where used. [b] Lagged 1 year in some specifications.
[c] In few cases, data on the closest available year or interpolation have been used to fill missing data. Relevant related data have been analyzed in these cases to assure validity of the procedure.
[d] Lagged 1 quarter.

Table A2. Descriptive statistics on explanatory variables

	Eastern & Southern Europe				Western & Northern Europe				Europe (27 countries)			
	mean	s.d.	min	max	mean	s.d.	min	max	mean	s.d.	min	max
EPL_2	2.38	0.47	1.74	3.36	2.06	0.52	1.10	2.89	2.27	0.51	1.10	3.36
GOV_EFFECT [a]	0.66	0.59	-0.69	1.86	1.81	0.21	1.43	2.24	1.19	0.73	-0.69	2.24
RULE_LAW [a]	0.55	0.65	-0.93	1.30	1.70	0.20	1.22	1.96	1.08	0.75	-0.93	1.96
SAT_GOV	3.53	1.02	1.53	5.11	4.82	0.89	2.78	6.28	4.08	1.13	1.53	6.28
GOV_EXPsq	17.14	4.81	7.13	26.93	22.75	6.21	11.37	32.60	21.50	1.90	7.13	32.60
INVEST_FREE	62.29	16.82	30.00	90.00	77.65	13.50	50.00	90.00	69.85	17.28	30.00	90.00
TRADE_FREE	79.29	9.08	44.20	86.60	83.14	2.62	79.80	87.20	81.24	6.95	44.20	86.60
BUS_FREE	69.93	10.82	40.50	85.30	86.33	9.45	70.00	100.00	78.13	13.12	40.50	100.00
MON_FREE [a]	77.66	5.42	62.80	85.70	85.16	2.61	80.50	90.00	81.25	5.48	62.80	89.90
TAX_WEDGE [a]	38.49	3.90	31.00	46.70	38.10	9.17	16.10	50.00	38.86	6.62	16.10	50.00
MIN_WAGE0	36.42	7.76	9.41	48.70	42.37	4.16	36.50	47.30	38.29	7.40	9.41	48.70
MIN_WAGE	36.42	7.76	9.41	48.70	42.37	2.61	36.50	47.30	38.29	6.31	9.41	48.70
NO_MINWAGE	0.00	0.00	0.00	0.00	0.59	0.50	0.00	1.00	0.27	0.45	0.00	1.00
UNION	19.46	10.33	10.20	44.99	43.52	25.06	10.92	84.01	31.72	22.72	7.76	84.01
GDP_PC [a]	8.68	0.78	6.83	9.70	10.26	0.17	10.04	10.64	9.42	0.97	6.83	10.64
GROWTH [b]	3.09	5.99	-17.8	10.80	2.13	2.43	-7.40	7.70	2.26	5.07	-17.8	10.80
IMMIGR	9.19	7.66	1.48	31.90	11.54	5.53	2.23	28.00	9.61	6.12	1.48	31.90
MINORITY	10.74	8.18	1.85	37.99	2.81	2.05	0.42	7.74	7.02	7.18	0.42	37.99
GINI [a]	31.46	5.56	22.00	43.70	27.35	3.05	23.40	34.60	29.62	4.93	22.00	43.70
LMP_ACTIVE [a]	0.04	0.02	0.01	0.10	0.16	0.07	0.06	0.34	0.10	0.08	0.01	0.34
LMP_PASSIVE [a]	0.06	0.05	0.02	0.19	0.23	0.12	0.03	0.49	0.15	0.13	0.02	0.49
UBSA [a]	48.48	13.40	20.00	73.00	68.97	6.23	60.00	82.00	57.75	15.41	8.00	81.00
TAX_RATE [a]	33.92	4.06	27.60	42.40	36.97	6.64	24.30	45.00	35.51	5.70	24.30	45.00
# obs. [# countries]	35 [14], except for *LMP_ACTIVE:* 31 [13]; *LMP_PASSIVE:* 29 [12]; *UBSA* 27 [12]; *GINI:* 34 [14]; *TAX_RATE* 30 [12]				34 [12], except for *MIN_WAGE0:* 14 [5]; *GINI:* 31 [11]; *TAX_RATE* 31 [11]				67 [27], except for *MIN_WAGE0:* 49 [20]; *LMP_ACTIVE:* 63 [26]; *LMP_PASSIVE:* 61 [25]; *UBSA* 59 [25]; *TAX_RATE* 30 [12]			
Estimation sample	Table 3A, all columns; Table 4, columns [2]-[5]				Table 5, all columns; Table 6, columns [1]-[3]				Table 6, columns [4]-[6]; Table 7, cols. [1a], [1b], [1c]			

Notes: Countries covered: Eastern & Southern Europe – see Notes to Table 3A; Western & Northern Europe – see Notes to Table 5; Europe (27 countries) – EU-27 (except for Cyprus, Luxembourg, and Malta), Norway, Russia, and Ukraine. [a] Lagged 1 year. [b] Lagged 1 quarter.
Sources: Calculation with data described in Table A1.

Annex 2 Instrumental variables and exogeneity tests

All models reported in this paper include one of the variables meant to measure the quality of governance and of public goods in general - *Government Effectiveness*, *Rule of Law* or *Satisfaction with the Government* (see Table A1 for details). Plausibly, same unobserved factors might affect both the (actual and perceived) quality of governance and the level of informal employment in a country. An instrumental-variable approach is used to address this potential endogeneity in each of the equations of the seemingly unrelated models reported in Tables 3, 5, and 7. Each of the tables reports two specifications of equations modeling the levels of informal dependent employment, informal self-employment, and unemployment in three country groups. Thus, we have 18 equations to test.

As instruments we use indicators based on three questions from the same round of ESS survey. These questions ask the respondent to evaluate, at a 0-to-10 scale, (i) Trust in the police (*POLICE*); (ii) Satisfaction with the state of healthcare in the country (*HEALTH)*; (iii) Statement „Most people try to be fair" (*FAIRNESS*). For each of these variables, we have tried (on each of the equations) the mean, the median and the 25th percentile, altogether 9 instruments. In theory, the first two variables can influence tax morale, but for 13 cases we could not reject the hypothesis of zero correlation between country-median (9 cases) or country-mean (4 cases) trust in the police and the disturbances in the informality (or unemployment) equations. In remaining cases we have used mean *HEALTH* (twice), mean *FAIRNESS*, the 25^{th} percentile of *FAIRNESS*, and, in one case, combination of the *DURATION* of ESS field work (in months) with the share of local born *MINORITY* population. In most cases, just one of the instruments appeared as convincingly valid and not weak, with one or few more in the grey zone. There have been no cases when different instruments provided conflicting evidence. The rationale for using different distribution parameters is as follows: the causal link (if any) between [dis]trust in the police and informal employment is likely to be rooted in the lower part of the trust distribution, thus affecting the 25^{th} percentile and the mean but not the median. On the other hand, the 25^{th} percentile of *FAIRNESS* (and hence it's mean as well) likely correlates with perceived government effectiveness, but not necessarily with the unobserved drivers of informality.

Table A3 reports the details of the tests. Exogeneity of the suspected variables is not rejected, with high enough p-values, in all but four cases (for which instrumented estimates are presented in Tables 5, 7). The whole set of instruments is never weak, as seen from first stage F-tests (see Greene, 2008: 350), but weak identification cannot be ruled out firmly in some cases. However, instrument validity tests by Anderson-Rubin (see Greene, 2008: 378-379) and Stock and Wright (2000) are weak-instrument-robust.

Table A2 Exogeneity tests

Eastern and Southern Europe (Table 3A)

Dependent variable (%)	Informal employees	Informal self-empl.	Unemployed	Informal employees	Informal self-empl.	Unemployed
Model	[1a]	[1b]	[1c]	[2a]	[2b]	[2c]
Suspected variable	*Rule of Law*			*Government Effectiveness* (lagged 1 year)		
Exogeneity test (p-value)	0.3388	0.4147	0.6729	0.7107	0.2810	0.4801
Excluded instruments	*POLICE* (median)	*POLICE* (median)	*POLICE* (median)	*POLICE* (mean)	*FAIRNESS* (p25)	*POLICE* (mean)
F-test, first stage	212.43	212.43	212.43	165.68	1318.81	165.68
F test of excluded instruments	3.40	3.40	3.40	4.87	23.51	4.87
Prob > F	0.0881	0.0881	0.0881	0.0460	0.0003	0.0460
Underidentification test (p-value)						
Kleibergen-Paap rk LM χ^2 test	0.0948	0.0948	0.0948	0.0489	0.0082	0.0489
Instrument validity (p-value)						
Anderson-Rubin Wald F test	0.2105	0.8846	0.6150	0.6769	0.4364	0.4941
Stock-Wright LM S stat., P> χ^2	0.1574	0.8627	0.5497	0.6135	0.3592	0.4078
# clusters/obs/regressors	14/35/9	14/35/9	14/35/9	14/35/11	14/35/11	14/35/11

Western and Northern Europe (Table 5)

Dependent variable (%)	**Informal employees**	Informal self-empl.	Unemployed	Informal employees	Informal self-empl.	**Unemployed**
Model	[1a]	[1b]	[1c]	[2a]	[2b]	**[2c]**
Suspected variable	*Government Effectiveness*			*Satisfaction with the Government*		
Exogeneity test (p-value)	**0.0161**	0.2962	0.7643	0.8199	0.5518	**0.0197**
Excluded instruments	*DURATION, MINORITY*	*POLICE* (median)	*POLICE* (median)	*HEALTH* (mean)	*HEALTH* (mean)	*POLICE* (mean)
F-test, first stage	12.85	60.21	30.40	16.52	17.52	36.45
F test of excluded instruments	5.20	3.03	3.53	3.49	4.69	9.72
Prob > F	0.0257	0.1096	0.0872	0.0884	0.0532	0.0098
Underidentification test (p-value)						
Kleibergen-Paap rk LM χ^2 test	0.0709	0.0279	0.0392	0.0649	0.0483	0.0125
Instrument validity (p-value)						
Anderson-Rubin Wald F test	0.5413	0.5872	0.9398	0.3656	0.4312	0.6829
Stock-Wright LM S stat., P> χ^2	0.4669	0.5307	0.9182	0.2569	0.297	0.5469
# clusters/obs/regressors	12/34/10	12/34/8	12/34/9	12/34/10	12/34/9	12/34/10

Europe (Table 7)

Dependent variable (%)	Informal employees	Informal self-empl.	Unemployed	Informal employees	Informal self-empl.	Unemployed
Model	[1a]	**[1b]**	[1c]	[2a]	**[2b]**	[2c]
Suspected variable	*Government Effectiveness*			*Government Effectiveness*		
Exogeneity test (p-value)	0.7959	**0.0222**	0.5516	0.6888	**0.0267**	0.8181
Excluded instruments	*POLICE* (median)	*POLICE* (median)	*POLICE* (median)	*POLICE* (mean)	*POLICE* (median)	*FAIRNESS* (mean)
F-test, first stage	80.49	80.49	80.49	61.57	135.07	72.96
F-test of excluded instruments	11.91	11.91	11.91	2.81	1.83	15.38
Prob > F	0.0019	0.0019	0.0019	0.1065	0.1884	0.0006
Underidentification test (p-value)						
Kleibergen-Paap rk LM χ^2 test	0.0081	0.0081	0.0081	0.1670	0.1819	0.0118
Instrument validity (p-value)						
Anderson-Rubin Wald F test	0.2749	0.6677	0.2411	0.3559	0.2265	0.2870
Stock-Wright LM S stat., P> χ^2	0.2315	0.6375	0.2002	0.3497	0.1594	0.1747
# clusters/obs/regressors	27/67/12	27/67/12	27/67/12	25/61/13	25/61/13	25/61/13

Notes: All statistics are country-cluster robust and het-robust. All models are exactly identified, except for Table 5: [1a], where overidentification test's p-value P(Hansen J > $\chi^2(1)$) = 0.6050. In all models, F-statistics of Kleibergen-Paap (2006) Wald rank test for weak identification equals that from F-test of excluded instruments. # regressors excludes constant and (for Table 5) partialled out variables. *Source:* Calculation with ESS data.